Xi-100 Non Contact Optical Profilometer User's Manual

Ambios Technology, Inc.
303 Potrero Street, Suite 42-303
Santa Cruz, California 95060
Telephone 877.429.4200
Fax 831.427.1160
Email sales@ambiostech.com

User's Manual (Rev. D) 5184

May 2004

Copyright Notice

Trademarks

Xi-100™, and the related Xi software are trademarks of Ambios Technology, Inc. Microsoft ™ is a registered trademark and Windows™ is a trademark of Microsoft Corporation. Pentium™ is a registered trademark of Intel Corporation. Dell™ is a registered trademark of Dell Corporation.

LIMITED WARRANTY

EXCEPT AS STATED BELOW IN THIS SECTION THIS PRODUCT IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Ambios Technology, Inc. does not warrant that the functions contained in the product will meet your requirements or that the operation of the product will be uninterrupted of error free.

Ambios Technology, Inc. does warrant as the only warranty provided to you, that the product which is furnished to you, will be free of defects in materials and workmanship under normal use for a period of twelve (12) months from the date of delivery to you as evidenced by a copy of your warranty receipt.

LIMITATIONS OF REMEDIES

Ambios Technology, Inc.'s entire liability and your exclusive remedy shall be:

1. the replacement of any hardware and software not meeting Ambios Technology, Inc.'s "Limited Warranty" and which is returned to Ambios Technology, Inc. or to an authorized Ambios Technology Inc. dealer with a copy of your purchase receipt, or
2. if Ambios Technology, Inc. or the dealer is unable within ninety (90) days to deliver a replacement product which is free of defects in material or workmanship, you may terminate this Agreement by returning the product and your money will be refunded to you by the dealer from whom you purchased the product.

IN NO EVENT WILL AMBIOS TECHNOLOGY, INC. BE LIABLE TO YOU FOR ANY DAMAGES, INCLUDING ANY LOST PROFITS, LOST SAVINGS OR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE SUCH PRODUCTS EVEN IF AMBIOS TECHNOLOGY, INC. OR AN AUTHORIZED DEALER HAD BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, OR FOR ANY CLAIM BY ANY OTHER PARTY.

SOME AREAS DO NOT ALLOW THE LIMITATIONS OR EXCLUSION OF LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

GENERAL

You may not sublicense, assign or transfer the license or the hardware, software, and documentation except as expressly provided in this Agreement. Any attempt otherwise to sublicense, assign or transfer any of the rights, duties or obligations hereunder is void.

The laws of the United States, and the state of California, U.S.A, will govern this Agreement.

Should you have any questions concerning this Agreement, you may contact Ambios Technology, Inc. by writing or calling:

Ambios Technology, Inc.
303 Potrero Street, Suite 42-303
Santa Cruz, CA 95060
Telephone 831.429.4200

YOU ACKNOWLEDGE THAT YOU HAVE READ THIS AGREEMENT, UNDERSTAND IT, AND AGREE TO BE BOUND BY ITS TERMS AND CONDITIONS. YOU FURTHER AGREE THAT IT IS THE COMPLETE AND EXCLUSIVE STATEMENT OF THE AGREEMENT BETWEEN YOU AND AMBIOS TECHNOLOGY, INC.

LICENSE AGREEMENT

YOU SHOULD CAREFULLY READ THE TERMS AND CONDITIONS BEFORE OPENING THE PACKAGE CONTAINING THE COMPUTER SOFTWARE AND HARDWARE LICENSED HEREUNDER. CONNECTING POWER TO THE Xi-100 SURFACE PROFILING UNIT INDICATES YOUR ACCEPTANCE OF THESE TERMS AND CONDITIONS. IF YOU DO NOT AGREE WITH THEM, YOU SHOULD PROMPTLY RETURN THE UNIT TO THE AMBIOS FACTORY.

Ambios Technology, Inc. provides the Xi-100 hardware and computer software program contained within the computer system, and licenses these products to you. You assume responsibility for the selection of the product suited to achieve your intended results, and for the installation, use and results obtained. Upon initial usage of the product your purchase price shall be considered a nonrefundable license fee unless prior written waivers are obtained from Ambios Technology, Inc.

License

a. You are granted a personal, nontransferable and non-exclusive license to use the hardware and software in this Agreement. Title and ownership of the hardware and software and documentation remain in Ambios Technology, Inc.;
b. you and your employees are required to protect the confidentiality of the hardware and the software. You may not distribute, disclose, or otherwise make the hardware and software or documentation available to any third party;
c. you may not copy or reproduce the hardware and software or documentation for any purpose
d. you may not assign or transfer the hardware and software or this license to any other person without the express written permission of Ambios Technology, Inc.;
e. you acknowledge that you are receiving only a LIMITED LICENSE TO USE the hardware and software and related documentation and that Ambios Technology, Inc. retains the title to the hardware and software and related documentation. You acknowledge that Ambios Technology, Inc. has a valuable proprietary interest in the hardware and software and documentation.

YOU MAY NOT USE, COPY, MODIFY, OR TRANSFER THE HARDWARE AND SOFTWARE, IN WHOLE OR IN ANY PART, WITHOUT THE PRIOR WRITTEN CONSENT OF AMBIOS TECHNOLOGY, INC.

IF YOU TRANSFER POSSESSION OF ANY PORTION OF THE HARDWARE OR SOFTWARE TO ANOTHER PARTY, YOUR LICENSE IS AUTOMATICALLY TERMINATED.

Term

The license is effective until terminated. You may terminate it at any other time by returning all hardware and software together with all copies of associated documentation. It will also terminate upon conditions set forth elsewhere in this Agreement or if you fail to comply with any term or condition set forth in this Agreement. You agree upon such termination to return the hardware and software together with all copies of associated documentation. In the event of termination the obligation of confidentiality shall survive.

Contents

Chapter 1 — Introduction

Chapter 2 — Setup

Chapter 3 — Image Acquisition

Chapter 4 — File Management

Chapter 5 — Image Display and Analysis

1 Introduction

Xi-100 Overview

The Ambios Xi-100 Non Contact Optical Profilometer is a metallurgical (reflected light) profiling microscope system measuring a field of up to 2 mm. Illumination is produced using the Kohler design (the light source is imaged to the objective aperture).The Xi-100 operates in smooth mode (phase shift) and texture mode (wave modes).You can also use microscope only mode to acquire an image of a sample without taking a vertical measurement.

The Ambios Xi-100 Non Contact Optical Profilometer is designed to image and measure smooth and rough surfaces with an X - Y range up to 2mm and a Z range to 100 µm.With appropriate vibration isolation and signal averaging, vertical resolution on the order of Å can be obtained for smooth mode.

The Xi-100 Non Contact Optical Profilometer provides precise, reproducible surface measurements, non-destructively through Michelson interferometry.The Xi-100 uses smooth mode to provide affordable high resolution optical profilometry for relatively smooth surfaces. For surfaces with very steep or discontinuous surface features, texture mode should be used to avoid the loss of signal and missing data points.

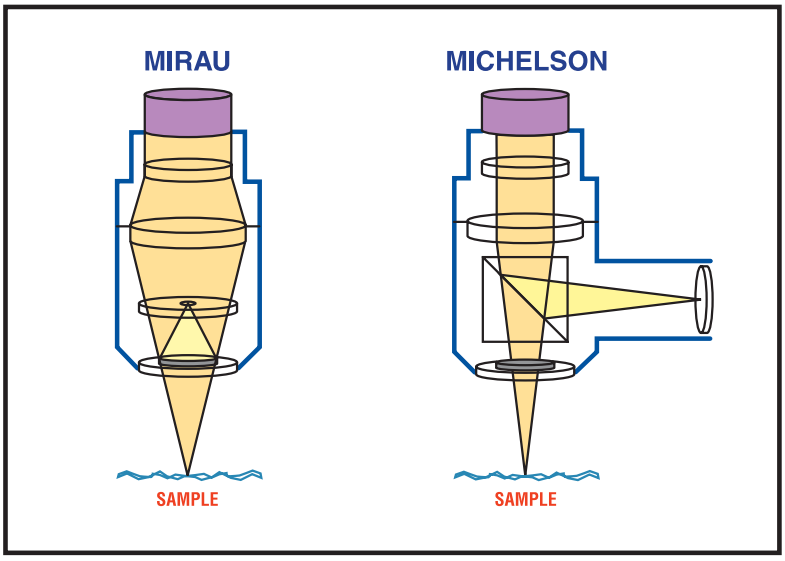
The Xi-100 can be used in applications that require measurements and/or speed of data capture which are beyond the capabilities of scanning probe microscopes including: fast, non-destructive (non-contact) surface roughness measurements; and surface topography measurements that are beyond the fine range of SPMs but smaller than those available from stylus profilers.

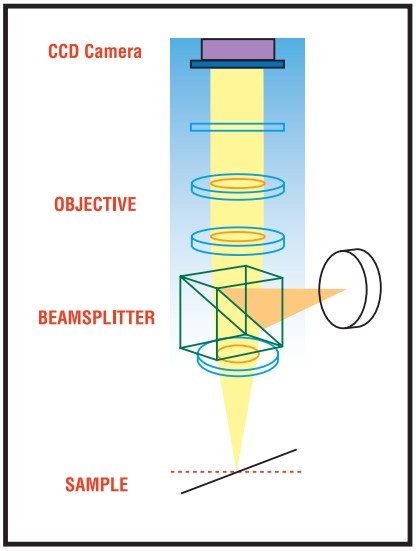
There must be at least 2% surface reflectivity for this instrument to work.

Operating Theory

The Ambios Xi-100 Non-Contact Optical Profiler uses Phase-shifting Interferometric Technology combined with an optical microscope to provide a non-contact 3D method of measuring the roughness of surfaces from the sub-nanometer to the micron scale.Areas in scale from microns to millimeters may be imaged rapidly. Interferometry has been a technique in existence for more than one hundred years and consists of viewing the optical path difference between a sample beam and a reference beam; the beams undergo constructive and destructive interference and this results in a pattern of bright and dark fringes.

In the case of an interference microscope, the objective lens is coupled with a beam splitter so that some of the light is reflected from a reference mirror at 90 degrees (Michelson type) or co-linear with the light path (Mirau type).

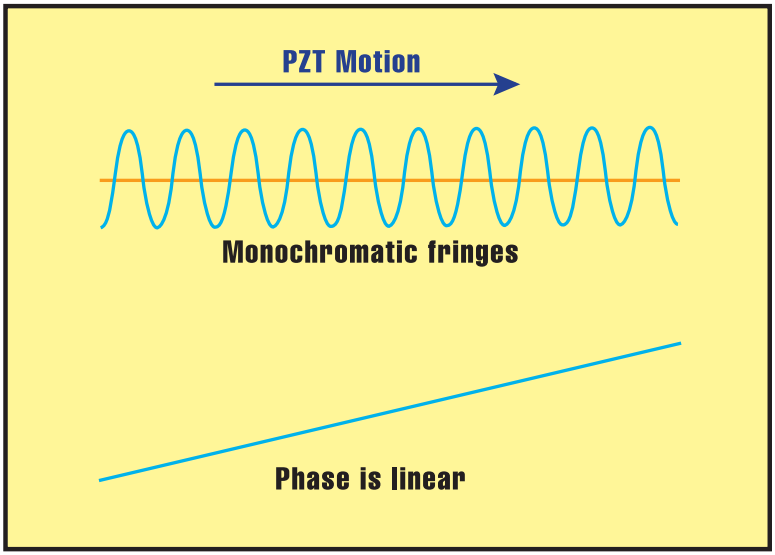




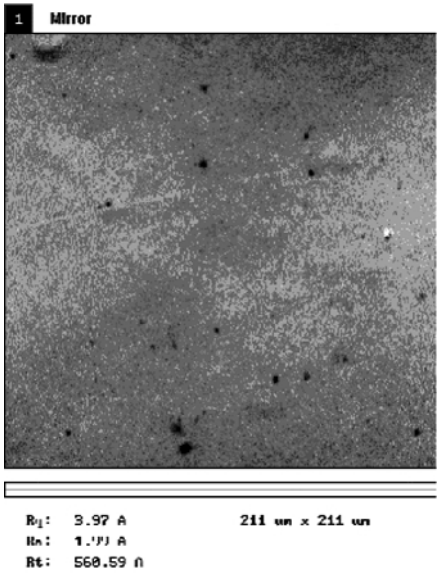
Illumination from a white light beam passes through a filter, then through a microscope objective lens to the sample surface. The light reflecting back from the surface recombines with the reference beam and interference fringes are formed. The pattern of these fringes is captured on a CCD camera array. If the sample is a perfectly flat mirror but tilted, and the illumination is by monochromatic light then the resulting interference pattern will be a series of fringes. The distance between the maximum of the dark or light fringes is proportional to the wavelength of light used and the tilt of the mirror. Each band in the interference pattern represents a contour height difference of 275 nm, half the wavelength of light (550nm) used in the measurement. The contour bands are purely sinusoidal and the phase of the interference fringe pattern can be measured to very high accuracy.

Smooth Mode (Phase Measurement)

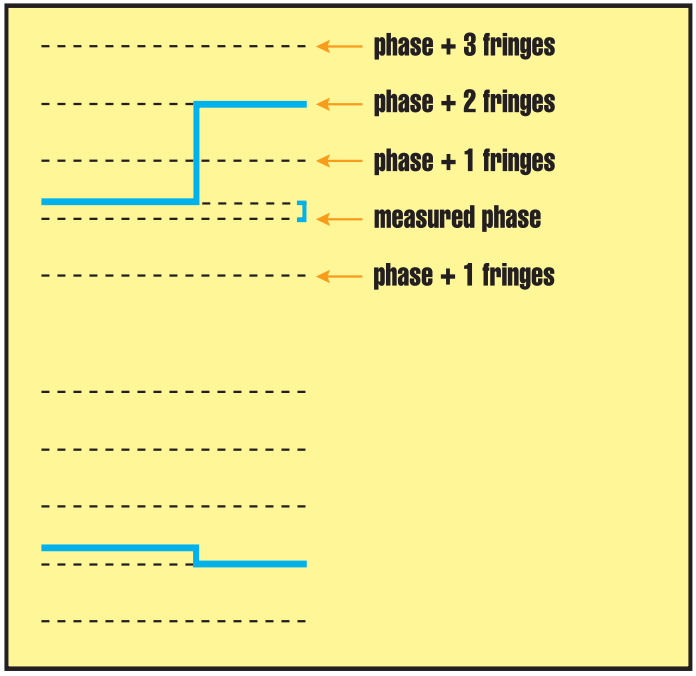
If the incident beam is moved vertically with respect to the sample surface, the fringe pattern will change from dark to light to dark for each 550nm movement.



Each pixel is sampled in this manner while the microscope head is moved precisely up and down using a piezoelectric translator above the sample surface. The phase differences for each pixel are determined by an algorithm and converted into height differences. The 3D profile of the surface measured is then reconstructed as a false-color map and displayed on the monitor together with surface roughness statistics. This method of producing a surface map is called Smooth Mode. It works particularly well for smooth surfaces where the typically peak-to-valley is less than 1 µm as illustrated by the image of an optical mirror surface below.



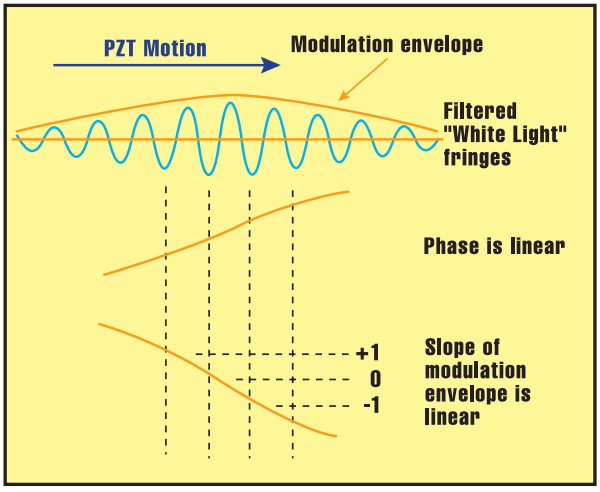
One disadvantage of Phase Measurement mode is that rough or discontinuous surfaces and steps produce ambiguous measurement data because all fringes look alike.



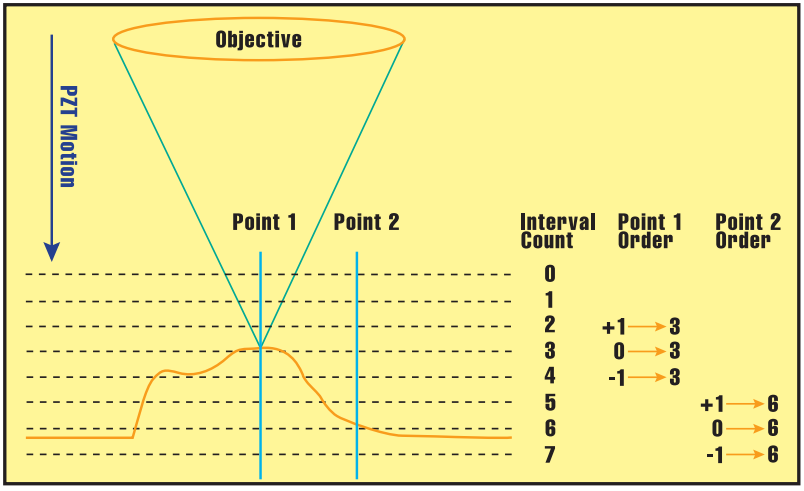
Imagine a particular point on the surface whose reflected image produces a black fringe on the CCD camera. Now if the next point on the surface captured on the adjoining pixel is at the same height, it will also be measured as a black pixel. However if this point is exactly 1/2 λ (wavelength) higher (275nm) it will also show a black pixel and similarly any multiple of this in height difference will result in an identical data point. Hence Smooth Mode can get confused when individual step height differences are larger than ~1/4 λ (137nm). This is not always the limitation it sounds, since by using a higher magnification objective, sharp steps can often be flattened. Hence the pixel height difference can be limited to less than 1/2 and data can still be collected. Phase measurement is an ideal technique for smooth surfaces without steps or discontinuities.

Texture Mode (White Light Measurement)

For measuring rougher surfaces or those with steps or discontinuities, a different technique is employed. When filtered white light filament source is used to illuminate the sample, the interference fringes are present over a very small depth of focus.



The interference fringes contain information about the phase to <1nm and also have a unique assignment of fringe count. The microscope head is scanned vertically through the surface focal point. The resulting camera images are stored as a series of frames rather like a sandwich stack.



Approximately 100 times more image data is acquired in Texture Mode than in Smooth Mode so the data capture is slower. The advantage of this so-called 'White Light' or texture mode is that steps and vertical peak-to-valley ranges may be measured beyond the microscope depth of focus, up to 100µm.

Windows Operating Environment

The manual assumes you have a general knowledge of computers and the Windows™ operating environment. Refer to the Microsoft Windows™ documentation for any information you need on the display control features of Windows.

Windows™ is a trademark of Microsoft Corporation.

2 Setup

Initial Inspection

The Ambios Xi-100 Non Contact Optical Profilometer is shipped in a specially designed carton. If the outside of the shipping carton is damaged, notify your shipping department immediately, they may wish to contact the carrier at this point. If the shipping carton is undamaged externally, carefully remove and identify all of the components listed below. If any components are missing, contact Ambios Technology, Inc. or your local representative. It is important to save the special carton for future storage or transportation of the Xi-100.

Packing list

The Xi-100 Non Contact Optical Profilometer consists of the following components:

- Accessory kit
- Control cable
- Frame Assembly
- Head unit
- Operating Manual
- Video cable

Xi-100

- Head Unit
- Frame Assembly
- Video cable and Control cable
- Operating Manual

Refer to the **Hardware Installation** section for instructions on setting up the Xi-100.

Accessory Kit

The Accessory Kit contains the following items:

Computer

Latest generation Intel™ processor based computer with keyboard and mouse, Windows™ operating system, Xi-100 Image Studio data acquisition and analysis software, and data analysis software.

Note: Refer to the computer manufacturer's instructions for setting up the computer.

Optional Equipment

The following optional equipment may also be included:

- Additional objectives (5X, 20X or 50X)
- Printer
- Vibration isolation table

Site Selection Considerations

Vibration, electromagnetic forces, air currents and temperature fluctuations can adversely affect the operation of the Xi-100. While it may not be possible to completely eliminate these sources of interference from the selected site, we recommend you provide as much isolation as possible using the suggestions provided here.

Vibration Isolation

The Xi-100 is sensitive to vibrations. You may want to quantify the vibrations of the room using an accelerometer if you have reason for concern.

Minimize vibrations for the Xi-100 by considering:

- Placing the Xi-100 on its own table and placing other equipment (computer, monitor, keyboard and mouse) on another surface. Consider purchasing an optical bench or vibration isolation table on which to place the Xi-100. This item can be purchased directly from Ambios.
- A location on the ground floor (or below ground) and close to an outside wall of the room. Building vibration is typically in the 10 to 100 Hz range and can adversely affect the Xi-100, even with only a 1-micrometer amplitude. The floor at the center of a room tends to act as a drumhead.
- A location as far as possible from foot and vehicular traffic, heavy equipment, fans, air conditioning units or other devices that emit excessive noise.
- Clamping the cables to the table or bench to prevent movement.

Electrical Isolation

It is important to minimize electromagnetic interference (EMI) at the site that may corrupt the measurement of small forces. The Xi-100's electronic components are designed to minimize the effects of EMI.

It is recommended that you prevent problems with electrical noise, ground loops and similar manifestations, by attaching the Xi-100 and the computer to filtered AC lines. Provide as much isolation from EMI as possible by considering:

- Setting up the System away from high-power electrical equipment such as motors, generators or electrical switching devices (such as relays) that emit EMI noise.
- Providing separate branch circuits for the Xi-100 and the Computer.
- Providing surge suppression or an uninterruptible power supply (UPS) for the branch circuit that powers the Xi-100.
- Grounding the vibration isolation table and other support equipment securely to the Xi-100 Computer.

Air Currents

- Avoid placing the Xi-100 where it will be subject to air currents from fans or ducts.

Temperature Fluctuations

- Locate the Xi-100 in an area that is not subject to rapid or frequent temperature changes and drafts due to heat or air conditioning ducts.
- Avoid placing the Xi-100 in a location where it be subject to direct sunlight.

Hardware Installation

Note: Always keep the Xi-100's original packaging materials. Refer to the instructions in Xi-100 Shipping Instructions, if you have to send the equipment back to the factory.

1. Unpack All Components

- Accessory kit
- Control cable
- Frame Assembly
- Head unit
- Operating Manual
- Video cable

Note: Follow the computer manufacturer's instructions to unpack and set up the computer.

2. Find a Suitable Location

Place the Xi-100 on a flat and stable surface.

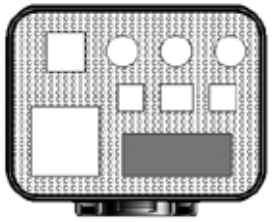
Place the Xi-100 in a room that is:

- Thermally stable
- Free from noise
- Free from vibration
- Free from drafts

Note: You can order a Vibration Isolation table directly from Ambios.

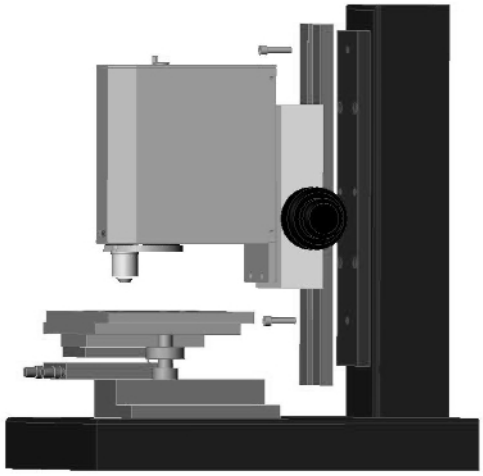
3. Attach the Xi-100 Head Unit

Accessory Kit

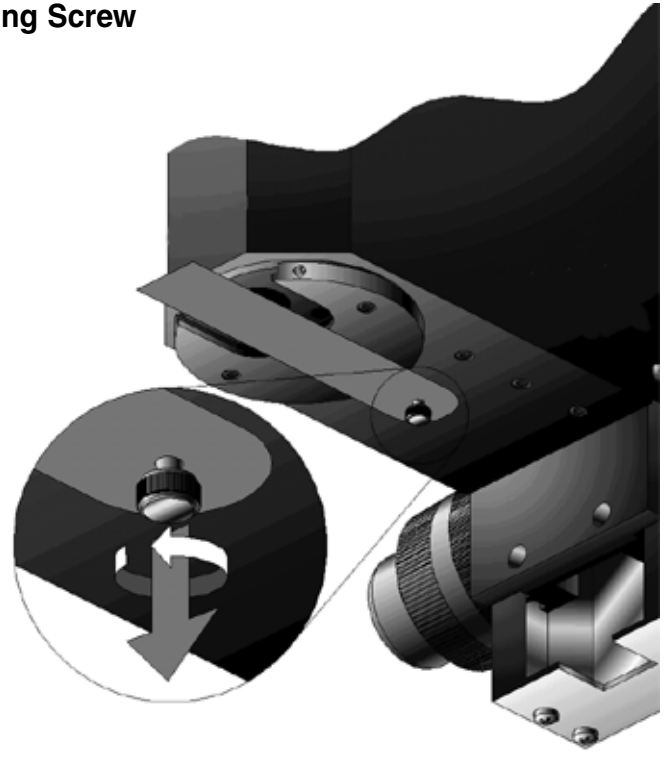


Using the large Hex Wrench and Screws from the Accessory Kit, attach the Head to the Frame as shown here.

CAUTION: The metal in the Head is soft, do not overtighten or cross thread the Screws!



4. Remove Shipping Screw



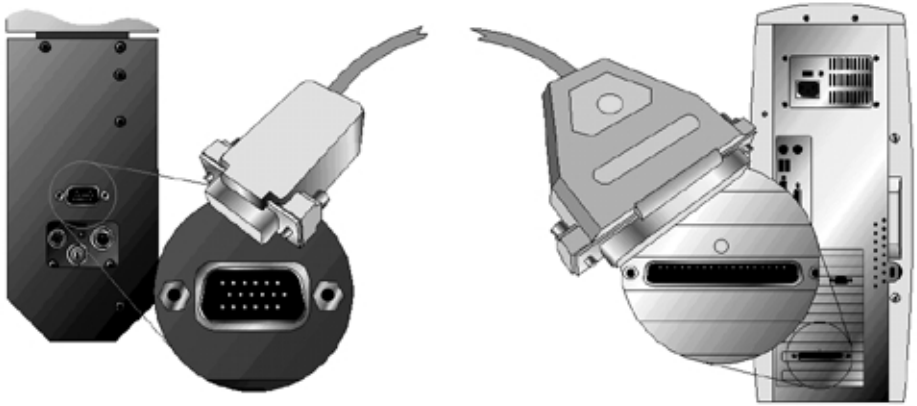
5. Attach Cables to the Back of the Frame

Cable attachments are provided on the back side of the granite frame to insure that vibrations transmitted through the cables are minimized.

6. Connect the Control Cable

Insert the small 15 pin connector into the 15 pin socket on the top of the Xi-100 Head Unit.

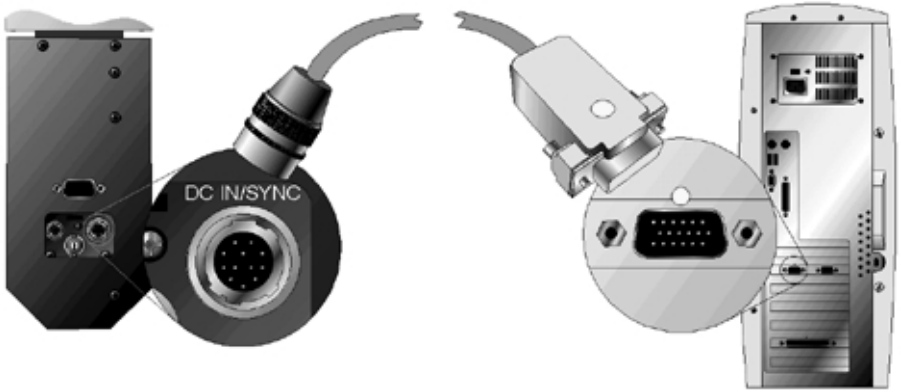
Insert the large 50 pin connector with the Green Dot into the 50 pin socket with the Green dot in the rear of your computer.



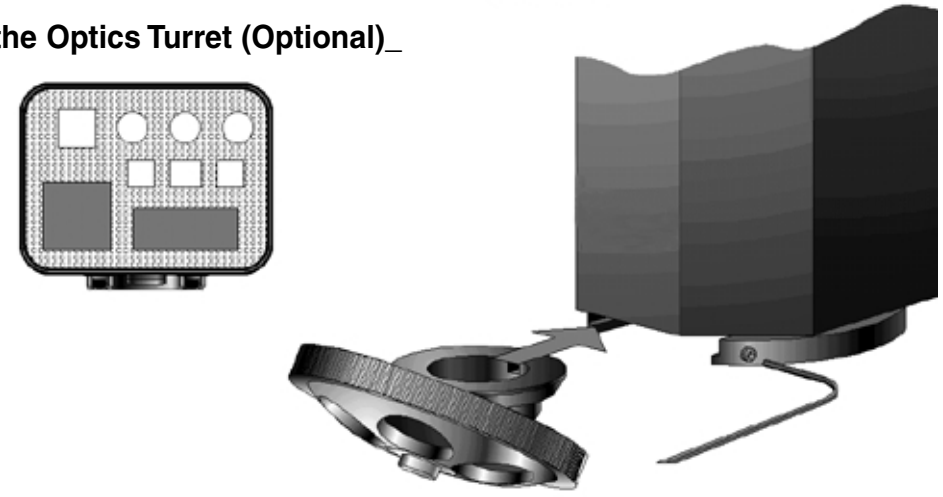
7. Connect the Video Cable

Insert the small round connector into the round socket marked DC IN/SYNC on the top of the Xi-100 Head Unit.

Insert the 15 pin connector with the Yellow Dot into the 15 pin socket with the Yellow Dot on the rear of your computer.



8. Insert the Optics Turret (Optional)_



Remove the Optics Turret from the Accessory Kit and slide it into the Head as shown here.

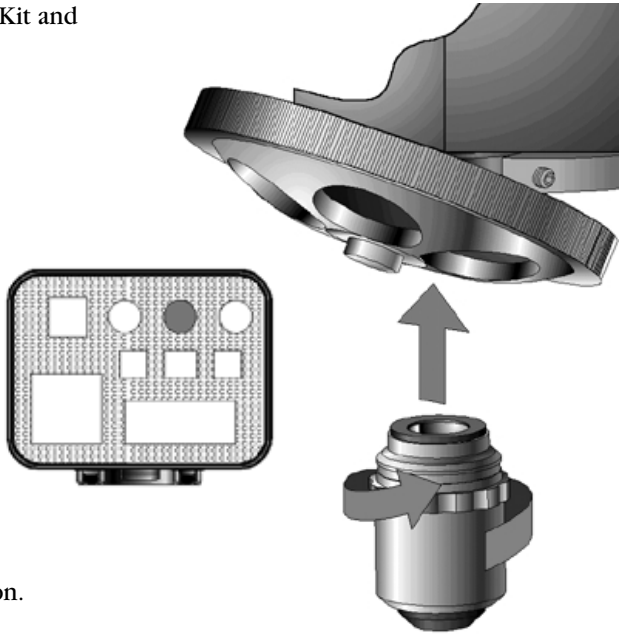
Use the .050″ Hex Wrench in the Accessory Kit to secure the Optics Turret.

Note: If you are using only one objective lens, you may want to use one of the extender tubes found in the Accessory Kit.

9. Insert the Optics Turret

Remove Objective(s) from the Accessory Kit and carefully thread them into the Turret.

Objectives are Fragile, Handle With Care.



10. Power Up

Press the Power Buttons on the Computer and the Monitor.

Start the Xi-100 Software — this will power the Xi-100 Unit.

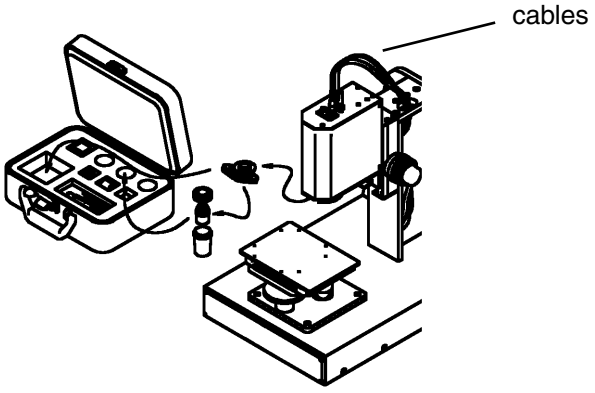
Consult your reference material for further information on the Xi-100.

You are now ready to use the Xi-100. Continue with Section 3, Image Acquisition.

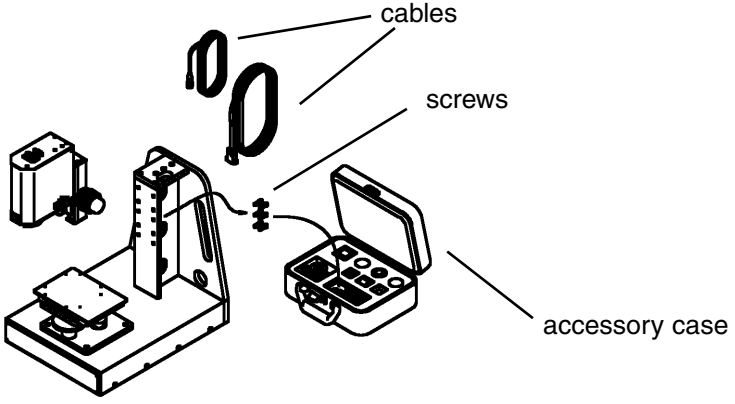
Xi-100 Shipping Instructions

Follow the instructions below if you ever need to ship the Xi-100 back to the factory.

1. Remove the objective(s) and place in the plastic shipping tube(s).
2. Place the plastic shipping tube(s) in the accessory case.
3. Remove the turret or the extender tube and place it in the accessory case.

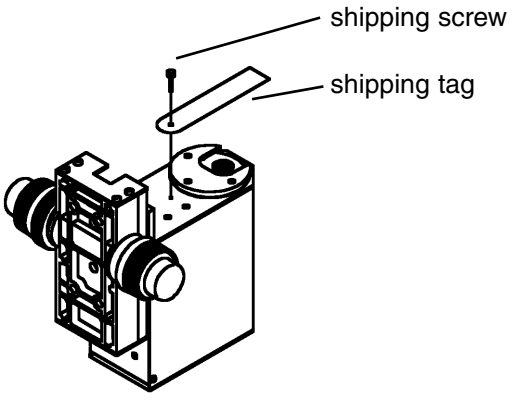


4. Remove the cables from the frame.
5. Remove the six screws holding the Xi-100 Optics Box to the Xi-100 frame and store the screws in the accessory case.

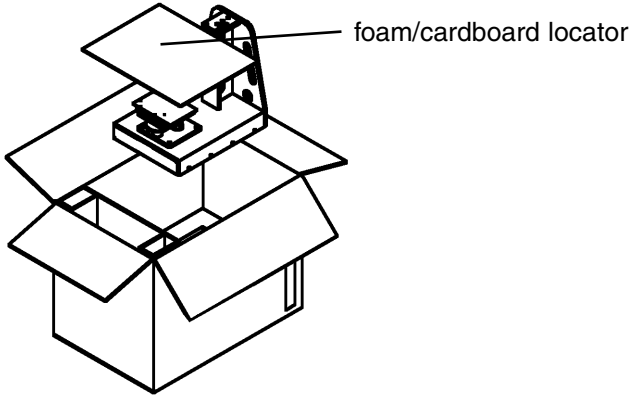


6. Install the shipping screw and shipping tag as shown.

7. Thread the screw into the underside of the head and finger tighten.This will prevent the delicate flexures from being overextended during the shipping process.

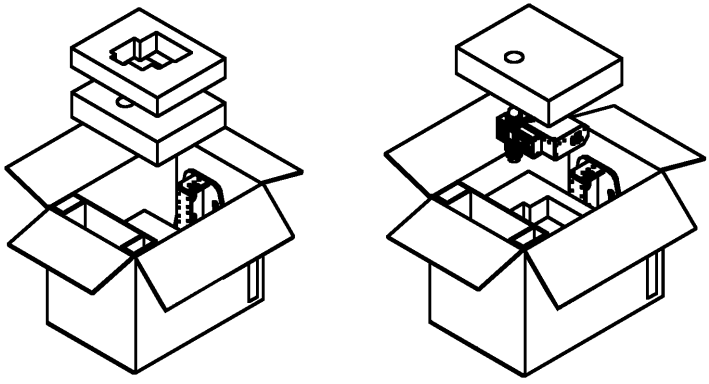


8. Place the Xi-100 frame into the shipping carton with the black rear support plate toward one end of the carton as shown below.
9. Place the foam/cardboard locator over the XY tilt stage.

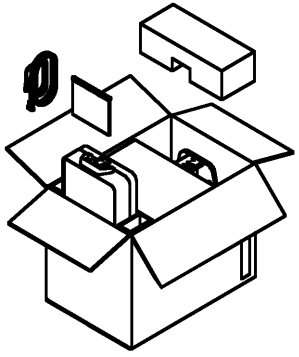


10. Place one of the pieces of foam (with the cylindrical cutout on top) of the foam/cardboard locator.
11. Place the foam with the optic box profile cutout on top of the first piece of foam.

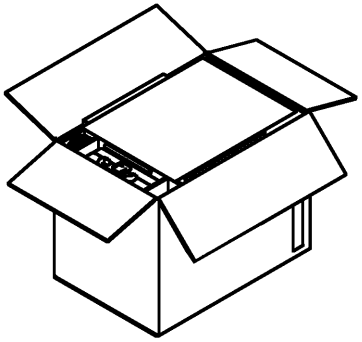
12. Place the optics box into the foam and place the second piece of foam (with the cylindrical cutout) over the optics box.



13. Put the cables, accessory kit, and manual into the shipping carton as shown.
14. Place the last piece of foam on top of the frame as shown below. This helps to secure the Xi-100 frame during shipment.



15. Put the setup poster on top of all of the foam.



16. Seal and ship to:

Ambios Technology, Inc.
~~303 Potrero Street, Suite 42 303~~
Santa Cruz, California 95060

3 Image Acquisition

Startup

You have set up the Xi-100 and are now ready to begin image acquisition.

To acquire an image:

1. Move the appropriate objective into position.

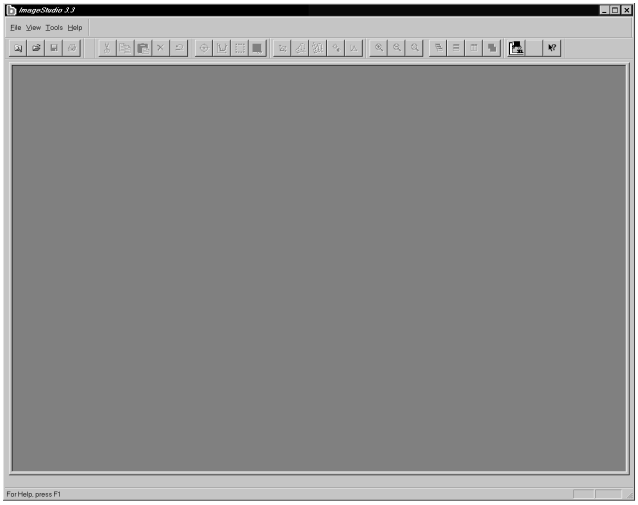
The field of view for objective lenses is fixed. Select an objective that will provide the appropriate field of view:

OBJECTIVE	FIELD OF VIEW
2.5x	2 mm
5x	1 mm
10x	0.5mm (500 microns)
20x	0.25mm (250 microns)
50x	0.1mm (100 microns)

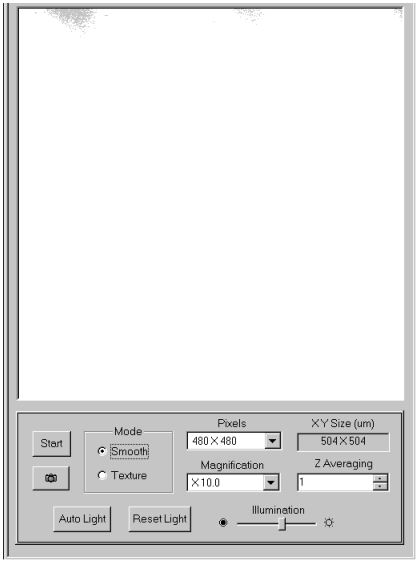
Note: If you are worried about vibration, we recommend that you use one objective with the extender tube, rather than the turret, which holds several objectives.

2. Turn on the computer.

3. Double click on the Xi-100 icon to start the software. The ImageStudio Main screen appears.



4. Click  (Controls Icon). The Capture screen appears.

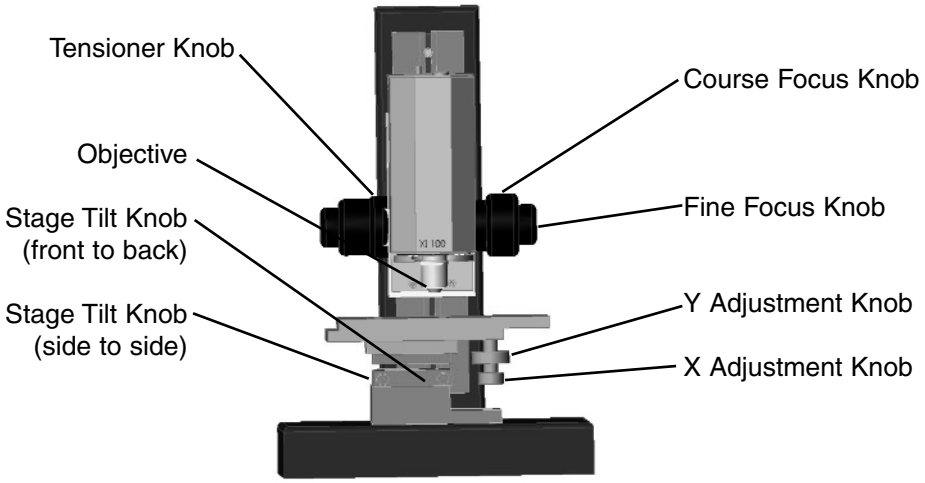


5. Choose the imaging mode you need (Smooth or Texture), then continue with the appropriate procedure.

Note: We suggest that you first image a smooth or texture sample from the accessory kit to become acquainted with fringes and tilt adjustment.

Imaging Modes

There are three imaging modes: smooth, texture, or microscope only.

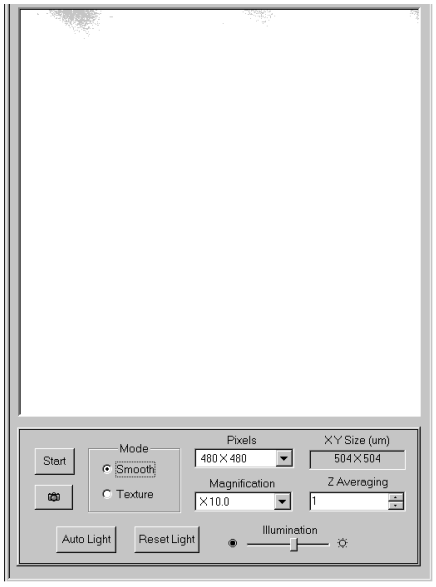


Smooth Mode

In Smooth Mode, Xi-100 measures objects that have a total topography within the vertical range of approximately three microns, with no steps greater than 100 nanometers (nm). Examples of objects with smooth surfaces: silicon wafers, lenses, etc.

Note: Before acquiring an image of your sample, we recommend that you use the mirror sample in the enclosed accessory kit and follow the procedure below to get a benchmark image of a smooth sample. Then repeat the procedure, using your own sample.

1. Check that the magnification in the drop-down list box on the Capture window matches that of the objective you are using. If necessary, change the magnification in the list box.



2. Mount the sample and use the X and Y adjustment knobs to position the area of interest midway under the green dot of light on the stage.

3. Adjust the illumination slider control to approximately 50%, or until the background on the screen approaches light gray.

4. Set Pixels listbox to Knife Edge.
   The Knife Edge feature provides a dark band at the far right of the screen. Observe this band to help you focus the image. When the band is clear (dark gray), you are in focus.

5. Using the Coarse Focus Knob, move the objective down until it is as close to the sample **without touching** it (approximately 2mm).

   CAUTION: Don't touch the sample; you will damage the objective.

6. Using the Coarse Focus Knob, slowly raise the objective, watching for the sample or the Knife Edge to come into focus.

7. Once you see something, you must confirm that it is the sample and not something in the light path. Use the X and Y adjustment knobs to see if the image moves. If it moves, it is the sample.

   Note: If the image is too bright or too dark, adjust the illumination. Once you have focused the image, change the pixel size to 480 x 480 for easy viewing.

8. Use the Fine Focus Knob to look for fringes. Fringes should appear as parallel bands of light and dark.

   Fringes represent the rise and fall (or tilt) of the sample surface. As you flatten the tilt (using the Tilt Adjustment knobs) you will reduce the number of fringes that appear on the computer screen. The direction of the tilt is perpendicular to the direction of the bands. For example, a series of horizontal bands indicates a tilt from front to back.

   Note: For best image acquisition, you should try to have no more than two fringes within the image.

9. Use the side-to-side knob on the left to reduce the vertical fringes.Then use the back-to-front knob to reduce the horizontal fringes.

   Note: If the sample goes out of focus during adjustment, use the Fine Focus knob to readjust the focus and retain the fringes.

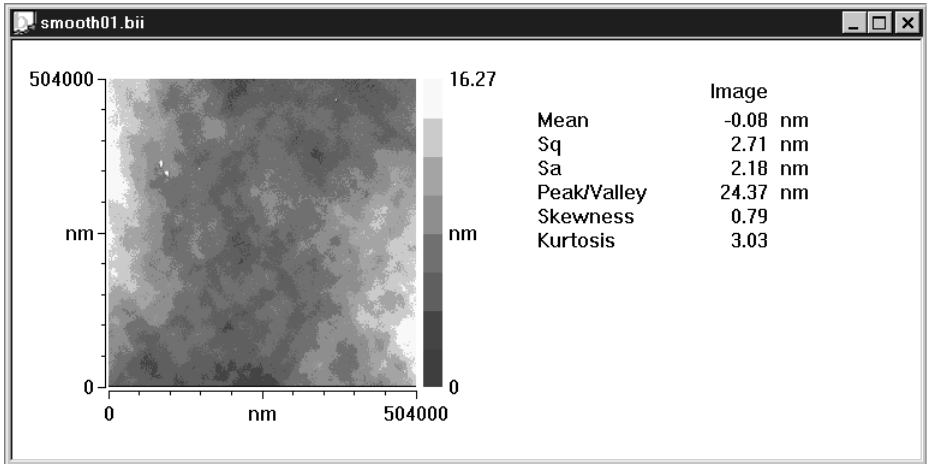
10. Maximize the contrast by adjusting the focus so that you can see the two fringes and the maximum contrast between them (adjust up and down through maximum to locate it most easily).

11. Click the Auto Light button to adjust the light source automatically.

    Note: Use the Reset Light button to re-establish the image's default set of conditions if you need to go back to the original light conditions.

12. Click the Start button to acquire the image.

    A progress dialog box appears as the system acquires the image, then a screen appears with the image and the image data:



13. If you want to average more than one image, increment the number in the Z averaging box on the Capture screen by clicking the up arrow.

    Proceed to **Chapter 5 Image Display** and Analysis to analyze the image.

Texture mode

In texture mode, depending on the objective lens used, the Xi-100 measures surface topography up to 2mm x 2mm x 100 mm (X,Y and Z).The data is collected as the objective scans vertically in Z. An example of an object with a textured surface is the metal door on a floppy disk.

Note: Before acquiring an image of your sample, we recommend that you use the textured sample in the accessory kit and follow the procedure below to get a benchmark example of a textured sample.Then repeat the procedure, using your own sample.

1. Check that the magnification in the list box matches that of the objective. If necessary, change the magnification in the list box.

2. Mount the sample and use the X and Y adjustment knobs to position the area of interest mid way under the green dot of light.

3. Set the illumination to 50% or adjust until the background on the screen approaches light gray.

4. Set Pixels to 480 x 480.

5. Using the Coarse Focus Knob, move the objective down until it is as close as you can get to the sample without touching it (approximately 1/8 inch).

CAUTION: Don't touch the sample; you will damage the objective.

6. Using the Coarse Focus Knob, slowly raise the objective, watching the knife edge for something to come into focus.

7. Once you see something, you must confirm that it is the sample and not something in the light path. Use the X and Y adjustment knobs to see if the image moves. If it moves, it is the sample.

Note: If the image is too bright or too dark, adjust the illumination.

8. If necessary, use the Fine Focus Knob to look for fringes. (The Fine Focus Knob has measurement numbers on it.) Fringes found in texture mode have different characteristics than those in smooth mode.Wavy or moiré patterns, contoured lines, and static-like patterns are all fringes indicating a rough texture.

Note: You should have at least one fringe in order to adjust the light intensity and find the maximum contrast. If the sample is not level, use the tilt table to level the platform, using your eye.

9. Once you find the fringes, use the Fine Focus knob to observe the fringe motion. Move the Fine Focus Knob *counterclockwise* (down) to the location where you notice the fringes disappear.

10. Record the number found on the Fine Focus knob (for example, 60 microns). This represents the lowest point of the sample.

11. Use the Fine Focus knob to observe the fringe motion once again, this time moving *clockwise* (up) to the location where the fringe motion disappears.

12. Record the number found on the Fine Focus knob (for example, 20 microns). This is the high point of your sample.

Note: This is a quick way to measure heights, if all you need is a rough estimate.

13. Subtract the first number from the second one (in this example, the result would be 40 microns). This is your vertical range, or distance from the lowest point to the highest point of your sample.

Note: The number of marks on the index indicate the difference in height from top to bottom. Crossing the zero mark may complicate the calculation. For example, if 20 is the low point and 80 is the high point, passing through the zero mark makes the difference between the two points 40, not 60 (which is what you would get if you subtracted the lower number from the higher number). In this case you don't want to subtract.

If the second number (high point) is larger than the first (low point), this means that you crossed the zero mark. To accommodate this, add 100 to the first number before subtracting.

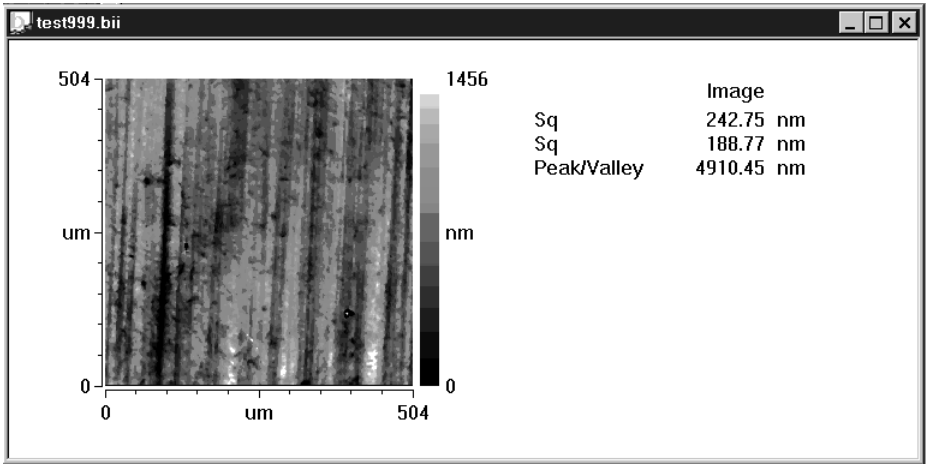
14. Turn the Fine Focus knob to a position halfway between the low and high values (for example, 40). This puts the focus in the correct position to measure slightly below the lowest point and go up to slightly higher than the highest point (based on the vertical range you calculated).

15. To set the Z-range, choose a number higher than your vertical range. For example, if your vertical range is 40, set the Z-range to 50.

16. Click the Auto Light button to adjust the light source automatically.

Note: Use the Reset Light button to re-establish the image's default set of conditions if you need to go back to the original light conditions.

17. Click the Start button to acquire the image.
    A progress dialog box appears as the system acquires the image, then a screen appears with the image and the image data:



Proceed to **Section 5 Image Display and Analysis** to analyze the image.

Microscope Only Mode

This mode allows you to acquire a picture of a sample with no vertical measurement taken.

4 File Management

The following file management features can be used with newly acquired images or stored images.

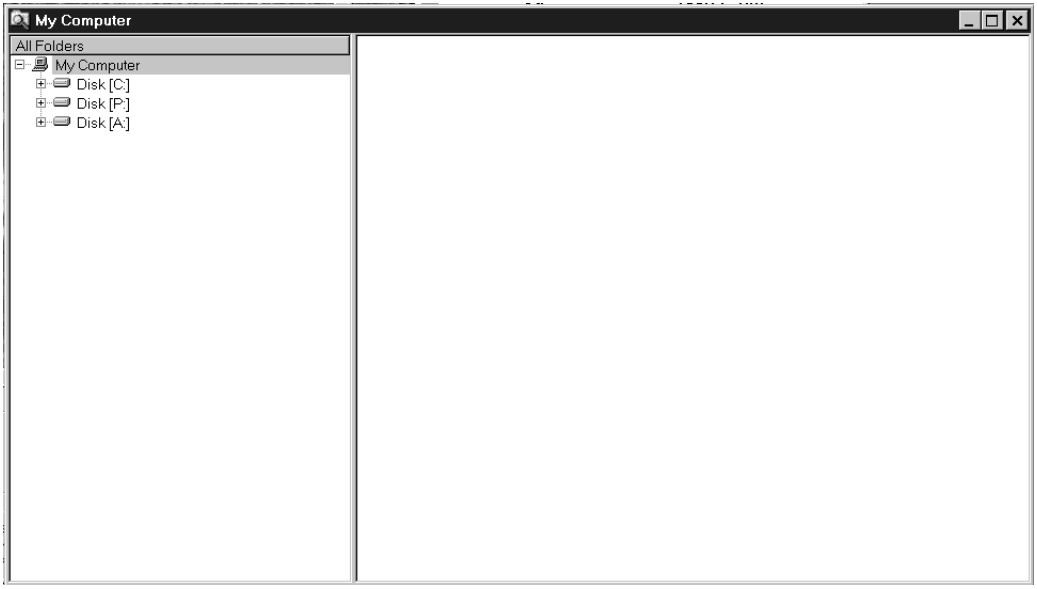
File Menu

The File menu provides commands for opening, closing and saving images. The Explore option offers expanded image search capabilities; the Workspace option gives you the opportunity to open, close and save your workspace.

Explore

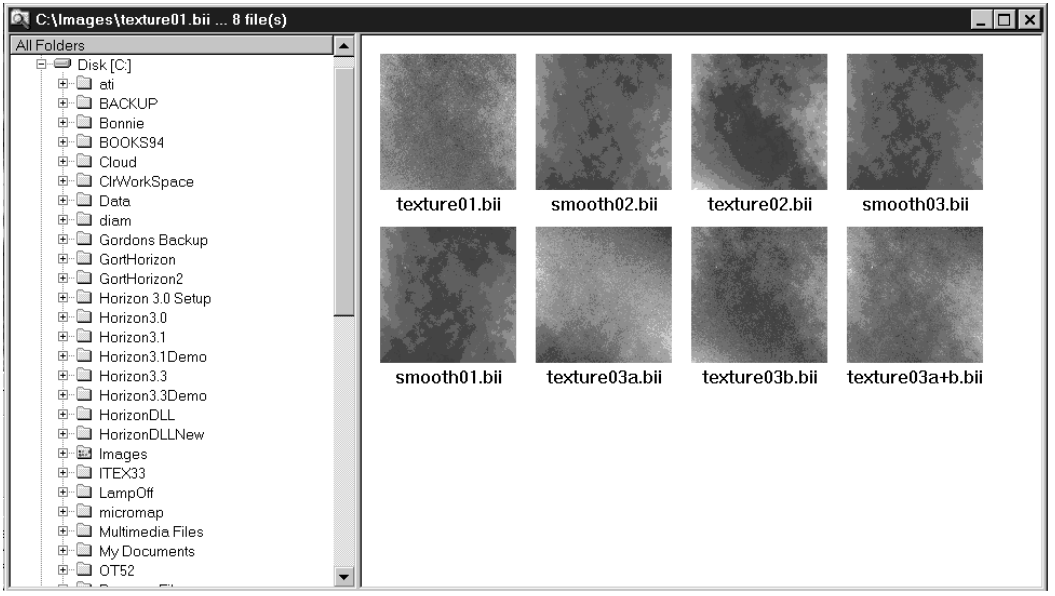
1. Select the Explore option to quickly search for image files.
   The first screen provides a list of disks on your computer.

2. Click on the + in front of the disk you want to open.



A list of folders (directories) appears.

3. Click on the + in front of the folder you want to open.
   The images in that folder appear on the right side of the Explore screen.

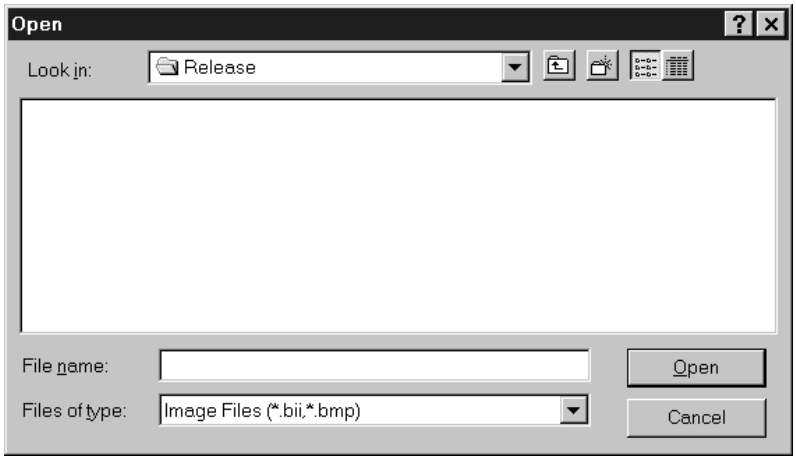


4. Click on the image that you want to work with.
   From here, right-click on an individual image and the following pop-up menu appears.

- Select Cut to remove the image from the directory and paste it in another location.
- Select Copy to make a copy of the image for pasting into another directory.
- Select Delete to remove the image from the disk permanently.

Open

The Open command reads a selected image file and displays it in a New Image window. Selecting this option first displays a standard Windows dialog box. Move to the desired directory, then double-click on the appropriate file and display it in a new Image window.



Close

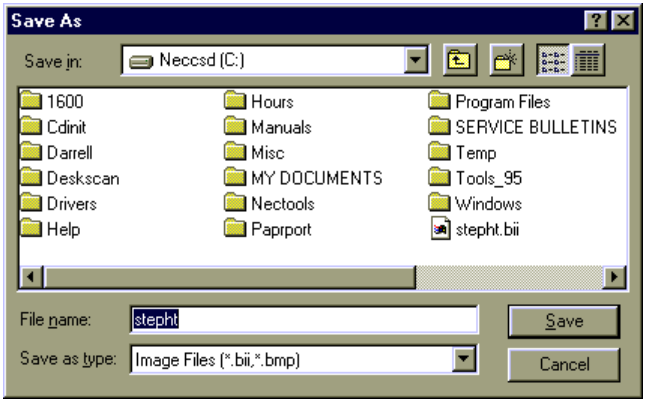
Select this command to close the image and return to the ImageStudio Main screen.

Save

Select this command to save the active image to file. If the image already has a name, it will be overwritten when you use this command. This allows you to replace an image with an updated version of itself.

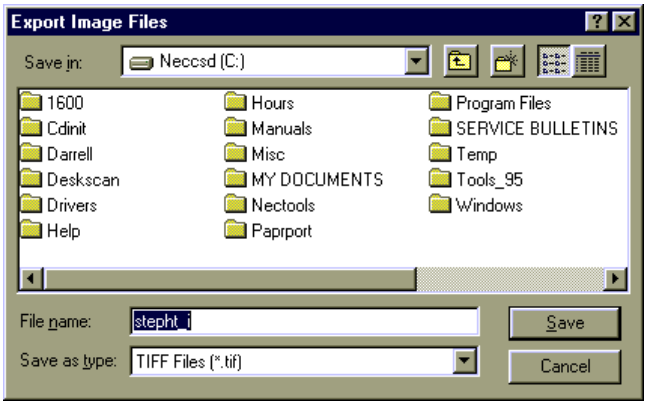
Save As

Select this command to save the image with a new name or to a new directory. Selecting this option displays a standard Windows dialog box:



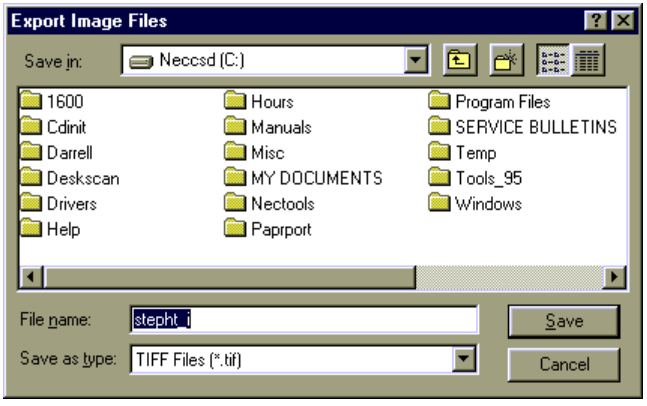
Output Image

Select this option to display a standard Windows dialog box. From here, you can export the image as a different file type. You can save files as .tif, .jpg, .tga, .bmp or .dib.



Output Data

Select this command to export the selected image or cross section as a text file (.txt) or binary file (.bii). Selecting this option displays a standard Windows dialog box:



Workspace

Select this command if you have customized your user interface and want to save it for future use. For more information on customizing the workspace, refer to the Customize section.

Print

Select this command to print either the active window or the entire window. Any installed printer can be used. If a full page printout is required, select the landscape format before printing.
To print,

1. Click  or select Print from the File menu.

A dialog box appears giving you two choices: Selected Image or Print Screen.

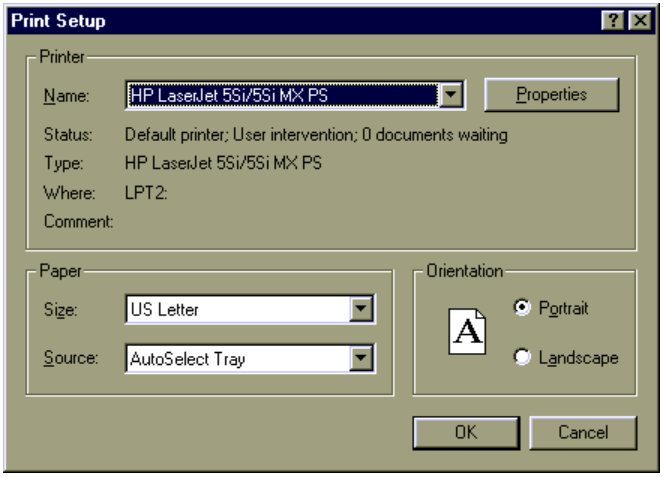
[SCREEN CAPTURE TBD]

- Click the Selected Image button to print only the active image.
- Click the Print Screen button to print the entire window of information, including all screens, menus and toolbars that show on your monitor.

The standard Windows Print Setup screen appears.

Print Setup

Select this command to access the Print screen to change print options. Selecting this option displays a standard Windows dialog box:



Most Recently Used File List

This list of most recently used files (MRU) is updated each time a file is opened or saved; up to five files are listed. To reopen one of these files, click on its entry in the MRU list.

Exit

Select this command to close down the software. All unsaved data will be lost.

Edit Menu

Copy (Copy to Clipboard)

Select this command to place a copy of an image, cross-section, histogram or 3D view on the system clipboard, from which it may be pasted into another application for presentation.

Undo

Undoes the most recent filter action (except for subtraction).

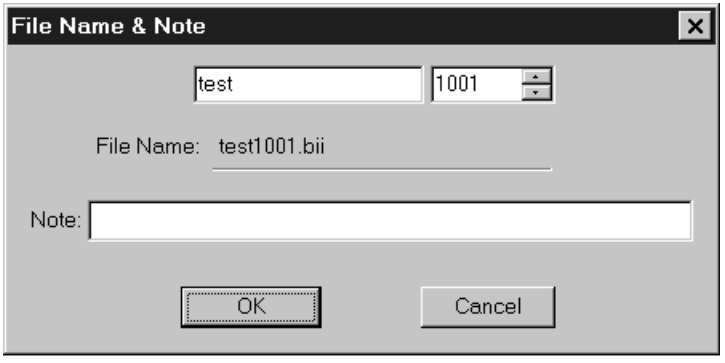
Image Menu

The Image Menu provides dialog boxes allowing you to sequentially number your images, view the parameters of the selected image, and set the defaults for the selected image. You can also access these features by right-clicking the mouse when you have the Capture screen active.

File Name & Note

Select this feature to give an image file a specific name and number. If you set the first image in a series here, each image that you capture after the first will be numbered sequentially. This is a handy feature when you are capturing many images of a particular sample.

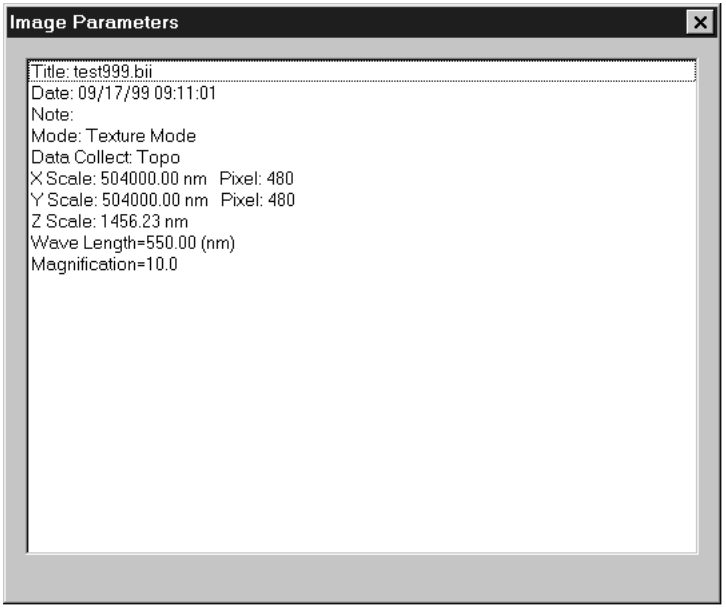
You can also provide a note if there is something that you need to remember about the image. For example, you can enter a date, a revision letter, or a few words about the image. The limit for the note is 128 characters.



Parameters

Select this feature to view the parameters on a particular image. You can also right-click the mouse on a particular image to access this feature.

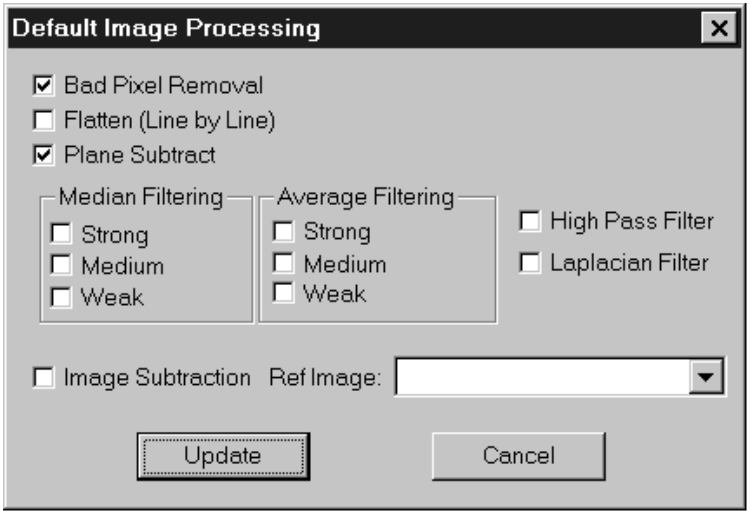
The following screen appears:



Defaults

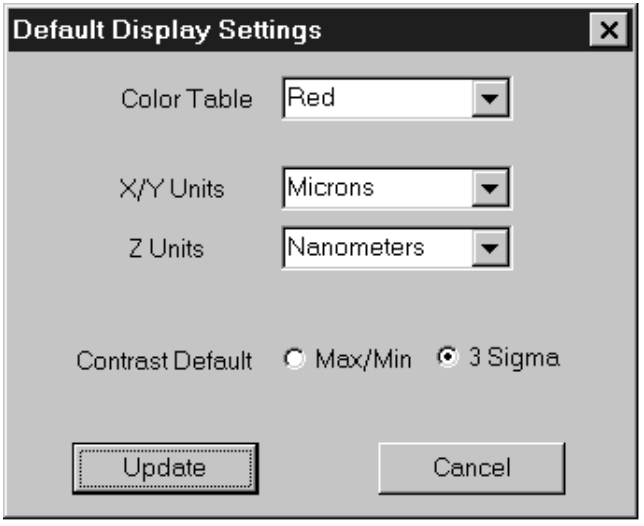
Processing

This screen allows you to set the image processing filter defaults for each image that you acquire. Refer to the section entitled, **Filters,** for more information on each filter.



Display

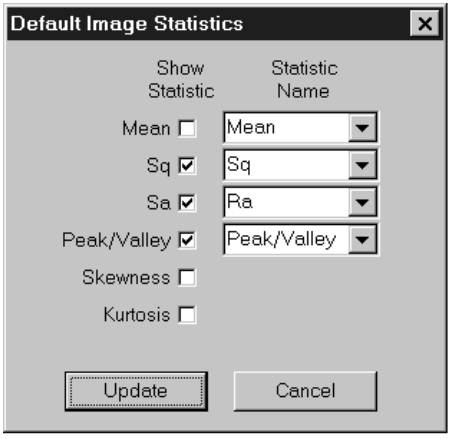
This screen allows you to set the measurement units that will appear on your image and the color scheme of the displayed image.



- Select a Color Table from the drop-down list. The selected image and subsequent images will appear in that color or the combination of colors you picked. Choices are: Monochrome, Standard, Cyan, Red, Olive, Aqua, Blue, Violet, Red/Aqua, Blue/Olive, Multi-gray, and System.
- Select the measurement for the X/Y Units. Choices are: millimeters, microns, nanometers and microinches.
- Select the measurement for the Z Units. Choices are: millimeters, microns, nanometers and microinches.
- Select the appropriate Contrast Default. 3D is best for most cases. For more information, refer to **Brightness & Contrast** in the **Image Display and Analysis** section.

Statistics

This screen allows you to determine which parameters will appear next to your acquired images. Click on the square after each parameter that you want displayed.



5 IMAGE DISPLAY AND ANALYSIS

This section provides information on viewing, analyzing and modifying acquired images.

Viewing Image Files

Viewing Menu

ImageStudio offers various ways in which you can view images.

3D Display

Select this command to view an interactive, light-shaded, 3-dimensional version of the active image.

Histogram

Select this command to view a graph that describes how many of the pixels (points) in an image have a particular height, or value of Z. You can click on the image once or twice to display a set(s) of measuring bars with which to measure different data. Refer to the section **Histogram** for more information.

Scale Bar

Select this command to display scales on the x and y axes with units and unit values listed.

Show All Controls

Select this command to display the Capture screen.

Reset Control Bars

Select this command to return to the default control settings set at the factory.

Status Bar

Select this command to display or remove the Status bar. A checkmark in the Status bar box under the View menu indicates that the Status bar is enabled.

Workbook Mode

Select this command to enable the workbook format, which provides tabs at the bottom of the screen for quick access to multiple images, cross sections, histograms, etc. There are four potential tabs for each image and each tab type is color-coded:

- Image = 
- Cross sections = 
- Histograms = 
- 3D Graphics = 

Click on the tab that you desire to view that particular item.

A checkmark in the Workbook Mode box under the View menu indicates that Workbook Mode is enabled.

Full Screen

Select this command to display the image as a full screen.

Analyzing Image Files

You can open saved files for review, comparison with other images and for taking measurements. You can perform a variety of standard Windows commands using the image file, such as copying it to the clipboard, renaming it, exporting and printing it. All these commands are accessible using the File and Edit commands. Some of these commands are also accessible using icons or on a drop-down menu. Refer to Appendix A for a description of each command. You can also review a summary of the parameters that were active when the image was captured.

Image Menu

There are a variety of affects you can apply to enhance or modify the appearance of a captured image. These commands are accessible from the pull-down Image and Tools menus, by clicking the appropriate icon on the toolbar, or by right-clicking the mouse on a selected image. Right-clicking produces a pop-up menu of choices for enhancing the image.

Note: You may want to make a copy of the image (using the Copy Image command under the Image menu) and apply one or more of these effects to the copied image for comparison with the original image.

3D Display

The 3D command displays a three-dimensional rendering of the selected image. This 3D view is useful both for presentation purposes and for gaining a better perspective of the surface topography.

Display a 3D view using the Image/3-D Display or click  . You can manipulate the 3D view in a variety of ways as described below. Experiment to find the feature that is best for your image.

- To freely rotate the 3D image, hold the left mouse button down and move the arrow as if rotating a trackball.
- To display a top view, select Top radio button.
- To redisplay the default perspective view, select Default radio button.
- To show or hide the axis, toggle the Show Axis checkbox.
- To use directional light to accentuate surface height, select the Dir Light checkbox (default).

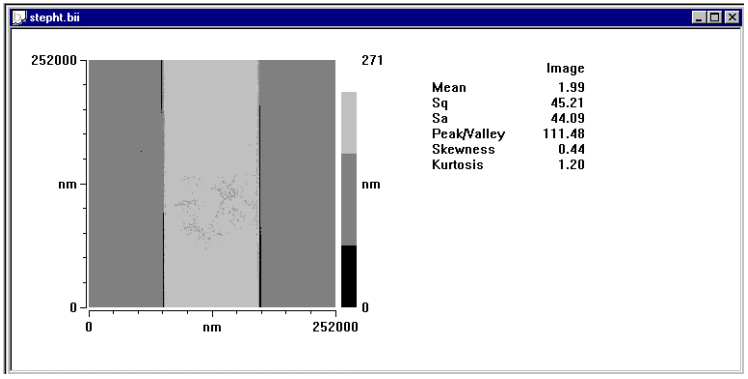
To change the brightness of the directional light source, adjust the Illumination slider bar.

- To use a different 3D view style, make a selection from the Style drop down list. The selections are Points, Wire mesh, Filled (the default, shows a solid surface), Ruled XZ (lines in the x direction), Ruled YZ (lines in the y direction), Lego (blocks), and Lego filled.
- To change the fraction of the data points displayed, make a selection from the Data Density drop down list. The selections are All (shows all points) and several fractions. 1/4 looks best for 256x256, 1/16 for 512x512. The more data points selected, the slower the image rotation response. In general, 1/64 looks best in all modes except filled and points.

To change the vertical magnification scale, enter values in the Z scale field. Values higher than 1 cause the topography to be accentuated (stretched) in the Z direction.

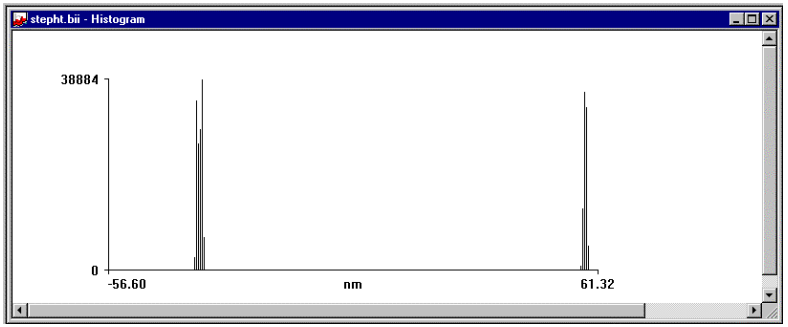
Histogram

A histogram is a graph that describes how many of the pixels (points) in an image have a particular height, or value of Z. The horizontal axis is the height; the vertical axis is the number of pixels in the image. If you measure a surface, there will be a distribution of heights, often Gaussian or multi-Gaussian. You can use the histogram to measure such items as step height, film thickness, and surface roughness.

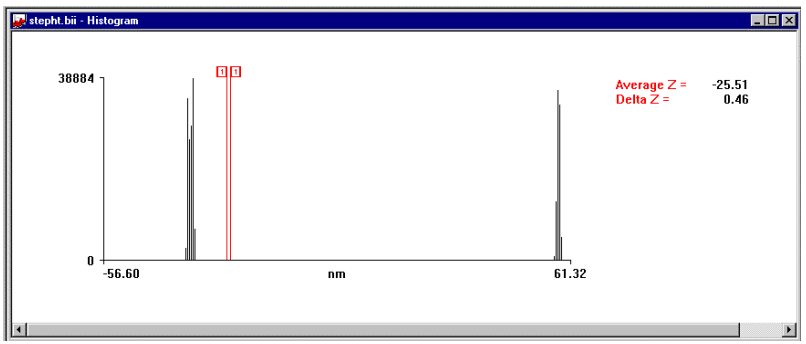


The above example has two surface heights, displaying a bimodal distribution (two Gaussian distributions).

1. Click  or select Histogram from the Image menu. The histogram of the active image appears.

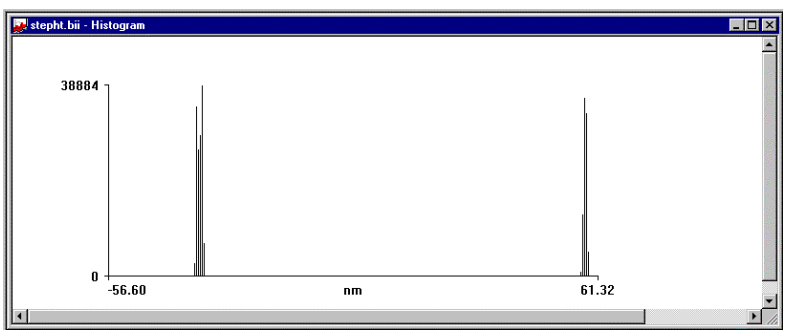


2. Click once anywhere on the image (with the mouse) and a set of two red measuring bars appears. Also, the Average Z and Delta Z measurements appear to the right of the screen.

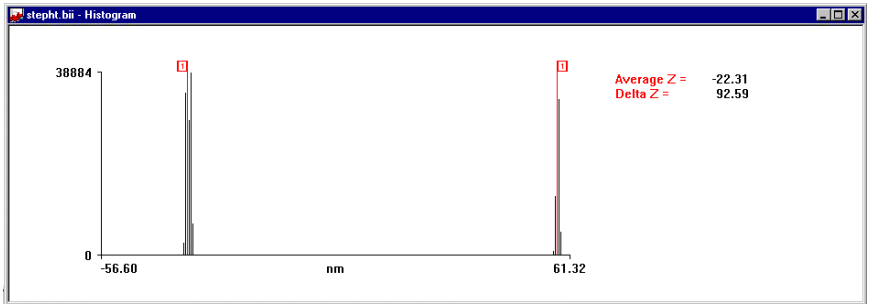


3. Place the mouse pointer on one of the boxes at the top of either measuring bar to move the bar.

- To measure the average height of one of the surfaces (represented by a single peak), place the measuring bars on either side of the distribution as shown.

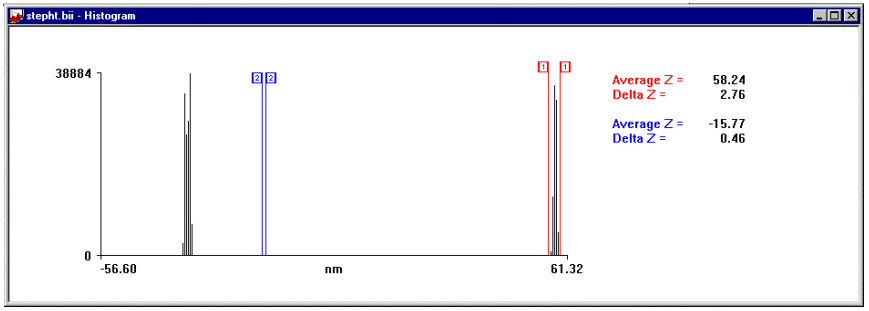


- To measure a Delta Z between two points (the vertical distance between two surfaces), place one flag in the center of one distribution and the other flag in the center of the second distribution as shown.

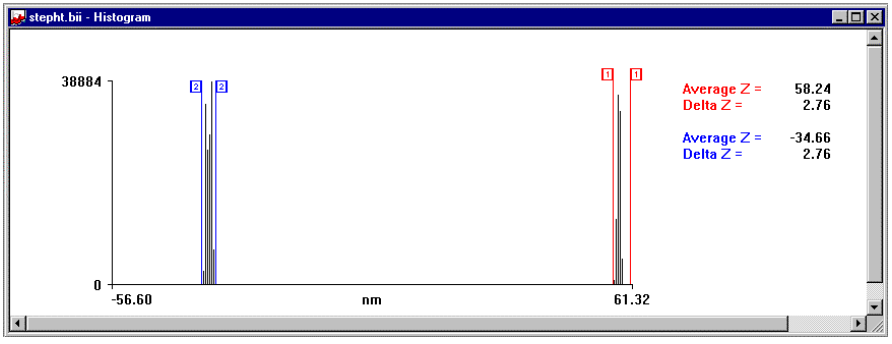


Note: The light colors on the image are the high points; the dark colors are the low points.

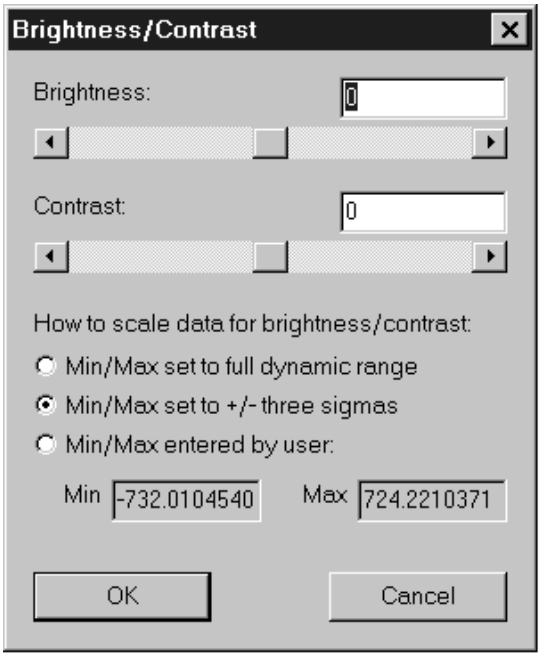
4. Click a second time and a set of blue measuring bars appears. Use these bars if you want to measure the second distribution.



To measure the height difference between two surfaces most accurately (best statistics), use one set of measuring bars for each distribution, then take the difference between the two values of Average Z to determine the height difference.



Brightness & Contrast



The Brightness & Contrast screen allows you to set the brightness and contrast for the image as well as the default scale data.

- Use the slider bars to adjust the brightness and contrast of the selected image. You will have to practice doing this until you find the right combination for the image.
- Select either Max/Min set to full dynamic range or Min/Max set to +/– 3 Sigma as the Contrast Default for your images (3 Sigma rejects noise; best for most cases).

The total range of dark to light can be scaled to the full dynamic range of the data or to a narrower subset that is less influenced by noise spikes (3 sigmas). Generally, we recommend that you select the 3 Sigma setting (the default) because it gives an image the best contrast.

However, in the case of a bimodal step height measurement, 3 Sigma may not allow the data to be viewed as clearly as Max/Min.

Color Tables

Use of color in an image may accentuate or highlight regions of the image. The Xi-100 provides the following color tables:

- Monochrome is gray scale
- Standard is the Ambios default, orange-red color
- Individual colors, such as cyan, red, olive, aqua, blue, violet
- Dual colors, such as red/aqua, blue/olive
- Multi-gray is useful to visualize the edges of flat surfaces
- System is 6-color

Crop Image

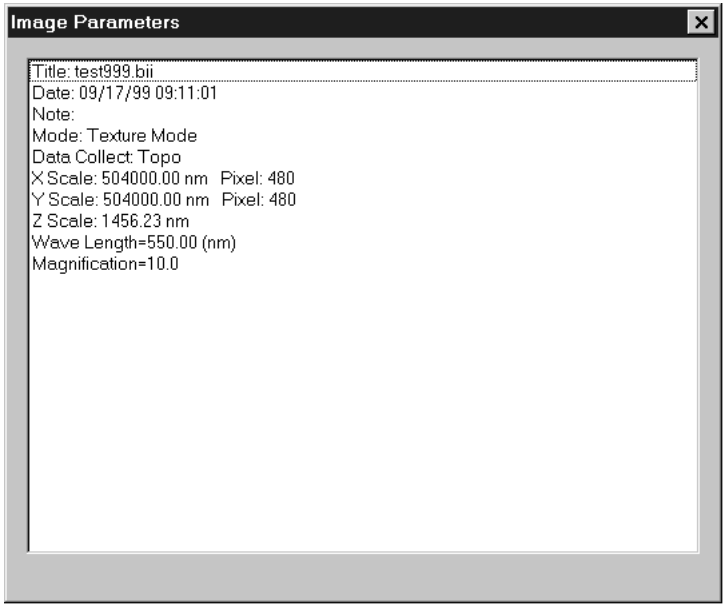
Select this command to separate a region from the whole image so you can get a closer look at it. When you crop a region, you can then use the brightness and contrast feature to see more detail in craters etc.

Copy Image

Select this command to compare two images, two cross sections, etc. When you make a copy, you can change the filters, or use some of the other effects and then compare the results to the original.

Parameters

Select this command to view a list of details about the selected image.



The parameters displayed are those that are in effect when the image was acquired.

- You can double-click on the "Note" line if you want to edit the note.

Filters Menu

The filters are each described below.

Fill bad pixels

There are some pixels that cannot be detected (no reflected light reaches the CCD camera); you cannot get a measurement for them. Select this feature to smooth out those pixels to produce a continuous surface.

Average

Displays a pull-down menu with Strong, Medium and Weak choices. Use to remove high-frequency noise from the image by smoothing.

Median

Displays a pull-down menu with Strong, Medium and Weak filters. Use to replace noise spikes by the median of the surrounding area.

Laplacian

Highlights edges (all directions) and either positive or negative brightness slopes. This filter uses different matrices (kernels) as shown below.

One	Two	Three	Four
0 1 0	1 -4 1	0 1 0	-1 -1 -1
-1 5 -1	-1 -1 -1	-1 -1 -1	-1 9 -1
-1 -1 -1	1 2 1	-2 4 -2	1 -2 1

High Pass. Accentuates the high-frequency details of an image. This filter uses different matrices (kernels) as shown below. The sum of each kernel is 1. The larger center coefficient greatly multiplies the new pixel value, while the smaller surrounding coefficients reduce the effect of the large center coefficient. The net effect is to intensify areas with large changes in pixel intensity, without affecting areas with constant pixel intensity.

Strong	Medium	Weak
-1 -1 -1	-1 9 -1	-1 -1 -1
-1 0 -1	0 5 0	-1 0 -1
1 -2 1	-2 5 -2	1 -2 1

Plane Subtract

Displays a pull-down menu with three selections for removing the tilt of the image to the best fit plane.

- Least Squares Plane Subtract. Automatically finds the least squares plane fit to the entire image and subtracts it.
- 3-Point Plane Subtract. Defines a flat plane for image background removal based on three user-selected points in the image. Click once to initiate selection of 3 points and a second time to subtract plane.
- Smooth Plane Subtract. Subtracts a smoothed background from the original image. This is similar to a high pass filter (the higher number of averages leaves more high frequency detail).

Flatten

- Line by Line. Levels the image front to back by removing discontinuities between adjacent lines.
- Exclude Region. Excludes a user-selected area from the line by line filter calculation. For example, the sample may have numerous bumps or holes that you don't want to include when applying the filter. Surrounding these features excludes them from the calculation of the average height of the line of data.
- Use Region. Calculates the line by line filter using only an area of the sample that you select.

Subtraction

- Allows you to determine the difference between a reference image and a subsequently acquired image.The images must be the same size.
- You can also use the multiplier to add images by changing the sign of the multiplier to a minus sign.

Tools Menu

Use the analysis tools to take measurements of the image.

Pixel Tool

To view the coordinates of any image pixel

1. Select Tools/Pixel Tool or click  , use the mouse to position the cursor at the area of interest. The x, y and z coordinates are displayed in the status bar at the bottom of the screen.
2. Click another area to move the cursor.
3. Double-click the left mouse button to remove the cursor from the screen.

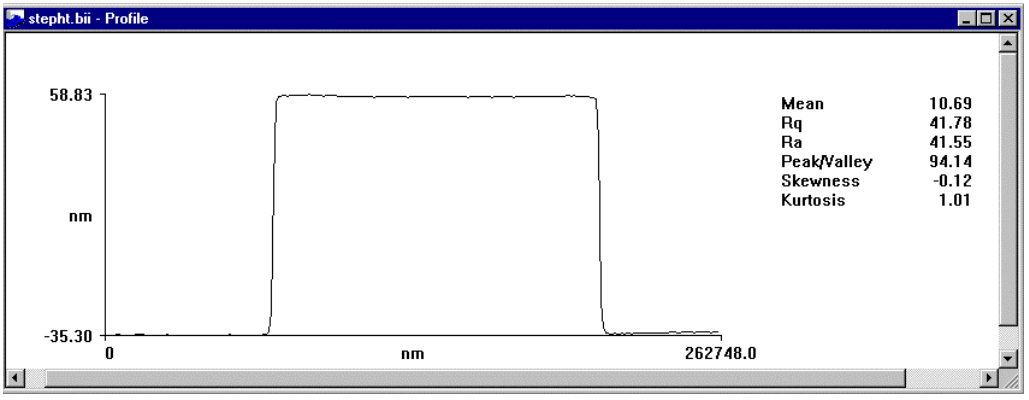
Profile Tool

To create a cross section profile and take measurements

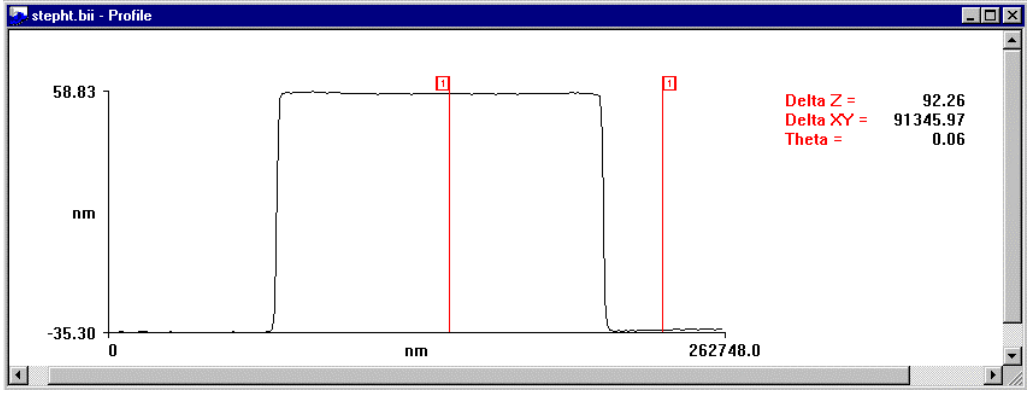
1. Select Tools/Profile Tool or click  .

2. Place the cursor at the point you want to begin the cross section, press and hold the left mouse button down while dragging the cursor to the point at which you want to end the cross section, then release the mouse button.

The cross section appears in a new window accompanied by roughness statistics.



3. On the cross-section, click the left mouse button to display a set of red colored markers. The position differences associated with the markers are displayed.



To make a **step height measurement,** move one marker to the top of a step and the other marker of the same set to the adjacent valley.

To make a **period measurement,** move one marker to the beginning of a step and the other marker of the same set to the beginning of the next (or subsequent) step.

4. Click a second time on the profile to display a set of blue colored markers if you want to take a second measurement. To remove a set of markers, drag them off the screen using the mouse.

Region Tool

To compare a region of the image with the entire image

1. Select Tools/Region Tool or click  .

2. Move the mouse to position the cursor near the area of interest, press and hold the left mouse button down while dragging the cursor over the area of interest, then release the mouse button. Statistics for the region in the box are displayed to the right of the data for the entire image.

3. Click the left mouse button to remove the box.

To measure step height

1. Select Tools/Region Tool or click  .

2. Place the cursor at the top of a light colored step, press and hold the left mouse button down while dragging the cursor to the bottom of the step, then release the mouse button.

3. Record the mean displayed on the right of the mean for the entire image.

4. Select Tools/Region Tool or click  .

5. Place the cursor at the top of a darker colored valley and measure this area the same as the step area described in step 1 above.

6. Subtract the mean of the valley from the mean of the step to obtain the step height.

Customize

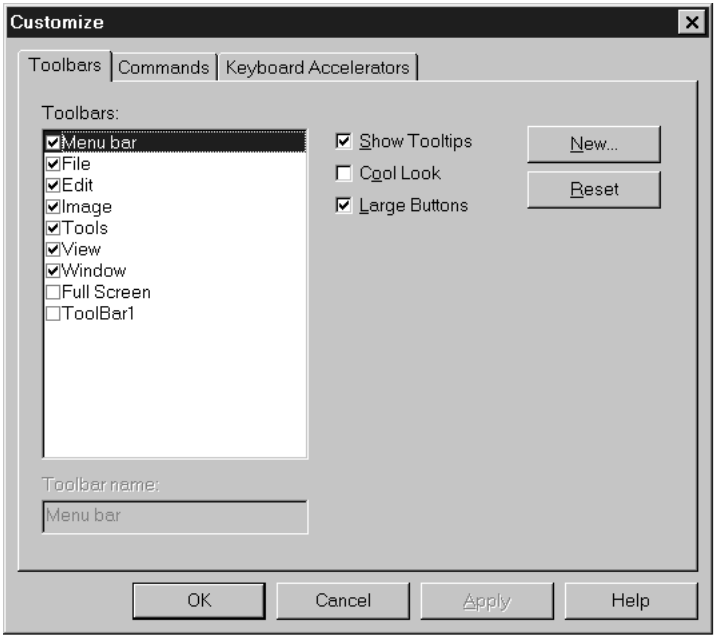
Allows you to customize the ImageStudio Main screen. Select Tools/Customize to use this feature, then click on the appropriate tab.

Toolbars Tab

This screen allows you to select the toolbars that will be available on the ImageStudio Main screen.

1. Place a checkmark in the boxes in front of the toolbars that you want to use.

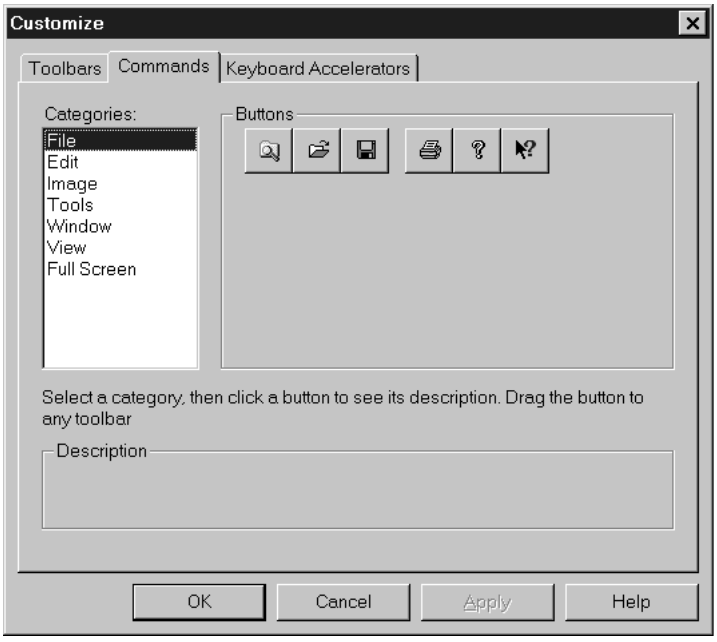
2. Click the New button. (Click Reset if you want to return to the default toolbars.)
   The toolbars you selected will now appear on the Main screen.



Commands Tab

This screen shows the icon commands associated with a particular menu. You can select the icons that you want to appear on each of the displayed toolbars. Use this feature to move icons around or make icon groupings.

- Click on the icon that you want to add and drag it onto the toolbar of your choice.

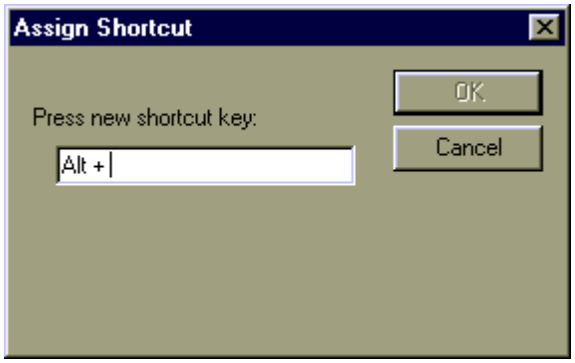


Keyboard Accelerators Tab

This screen allows you to create shortcuts for some commands.

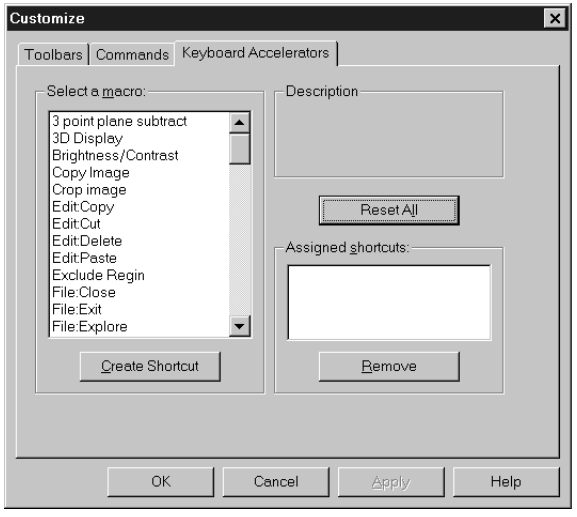
1. Select the command you want in the Select a macro box.

2. Click the Create Shortcut button. A dialog box appears.



3. Enter the shortcut name/key. The new shortcut appears in the Assigned shortcuts box.

- Click Remove to delete assigned shortcuts.
- Click Reset All to return to the default selections.



Window Menu

Cascade

Select this command to arrange all windows in an overlapping arrangement.

Tile Horizontally

Select this command to arrange all windows in a horizontal non-overlapping arrangement.

Tile Vertically

Select this command to arrange all windows in a vertical non-overlapping arrangement.

Zoom In

Select this command to magnify the image. This only affects what is viewed; the full image is still in memory. Any filters or analysis will be applied to the entire image; however, if a magnified view is filtered, the view will remain zoomed in.

Zoom Out

Select this command to view a smaller image. Selecting this several times will continue to reduce the size of the image.

Reset Zoom

Select this command to view the image at its original size.

Close All Windows

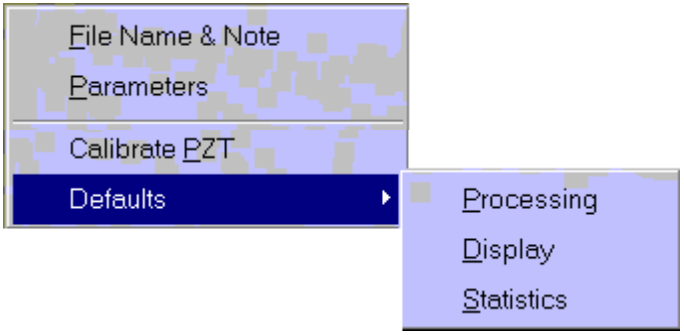
Select this command to close all windows on the screen.

Most Recently Used Documents

Use this list to open recently used documents. This list is updated every time a file is opened or saved; up to five files are listed. To reopen one of these files, click on its entry in the MRU list.

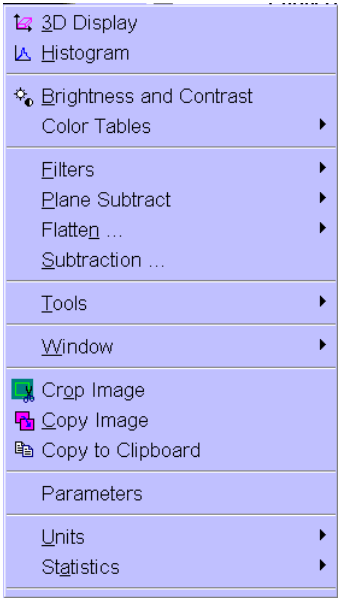
Right Clicking on the Capture Window

Right-clicking on the Capture window provides the following options (which can also be accessed using menus or toolbar icons). Refer to the appropriate section in this manual for more information on a particular option.



Right-Clicking on the Image

Right-clicking on the image provides the following options (which can also be accessed using menus or toolbar icons). Refer to the appropriate section in this manual for more information on a particular option.



Units

Select this command to change the units displayed on the screen.

Statistics

Select this command to change the statistics displayed on the screen. You can choose whether to show a statistic on the screen or not. You can also select a name for the statistic from the drop-down list that appears next to the statistic.

Appendix

A Software Reference

The Xi-100 software was designed with a flexible interface to help you easily and quickly access commands. To access commands, you can:

- Use the main menu commands (File, Edit, …) and select a menu item
- Select a button (icon) from the toolbar. The toolbar contains a subset of the main menu commands.
- Select the command from a drop-down list displayed when you click the left mouse button on a Xi-100 window. This list contains a subset of the main menu commands.

Table A-1 lists all the main menu commands, identifies corresponding icons and if the command is available on the drop-down list. Commands with an asterisk (*) are available only when an image is displayed. Hot keys for a command are identified on the appropriate menu by an underline.

Table A-1. Xi-100 Menus

MENU	COMMAND	DESCRIPTION
File	Explore	Offers quick and easy search capabilities for images
	Open	 Displays the Open dialog for selecting an image file (bii, bmp, img and smp) to open.
	Close*	Closes all windows of a data file.
	Save*	 Saves the displayed information in a file or resaves an altered file.
	Save As*	Displays the Save As dialog to save the information in a file.
	Output Image*	Displays the Export Image file dialog to export the image to other applications.
	Output Data	Displays the Export Image data dialog to export the image, cross section, or histogram data as a text file to other applications.
	Workspace	Displays a drop-down list with commands (Open, Save, Close and Save As) to use the workspace. Workspaces are .wsp files that are useful when multiple users use ImageStudio. Each user can create a custom workspace that contains the user's preferred settings and arrangements of dialogs. When this user wants to scan images or review data, the user simply opens this customized "environment."
	Print*	 Displays the Print dialog to print the screen or current window.
	Print Setup*	Displays the Print Setup dialog for selecting printing information.

MENU	COMMAND	DESCRIPTION
File continued	Recent Files*	Lists the names of files that have been opened recently.
	Exit	Closes ImageStudio.
Edit*	Copy	 Copies the selected window to the clipboard, from which it can be pasted into other Windows applications.
	Undo	 Undoes the last edit or filter.
	Redo	Cancels your last undo command.
View	3D Display	 Displays a 3-dimensional view of the image that you can rotate.
	Histogram*	 Displays the concentration of data values as a graph with two sets of measurement bars that you can use to obtain information on Delta Z, or Average Z of a distribution of Z values.
	Scale Bar	Displays scales on the x and y axes with zero values, unit names and upper values listed.
	Show All Controls	 Displays the Scan Controls, Mode Controls and Scan Settings dialogs on the lower portion of the screen.
	Status Bar	Enables and disables displaying the status bar below the image area and above the Scan Controls area. A checkmark indicates the Status Bar is enabled.
	Workbook Mode	Enables and disables displaying data (images and profiles) on the screen using a workbook format with tabs at the bottom of each for quick access. A checkmark indicates the Workbook mode is enabled.
	Full Screen	Enables and disables displaying the image as a full screen.
Image*	3-D Display	 Displays an image as a three-dimensional view. Refer to **3D Display** for more information.
	Histogram	 Displays the concentration of data values as a graph with two sets of measurement bars that you can use to obtain information on Delta Z, or Average Z of a distribution of Z values.
	Brightness & Contrast	 Displays the Brightness and Contrast dialog with slider bars and numeric fields to adjust both functions and options for scaling data.
	Color Tables	Displays a drop-down list to select a Monochromatic, Standard or one of the ten Defined Color Tables that may enhance the image display.
	Crop Image	Allows you to select a region on an image to view in greater detail.
	Copy Image	Makes a copy of the selected image in a new Window.
	Parameters	Displays the Image Parameters dialog to review a summary of the parameters that were selected when the image was scanned.

MENU	COMMAND	DESCRIPTION
Filters*	Fill Bad Pixels	 Smooths out pixels from which a signal was not detected.
	Average	Displays a drop-down menu with Strong, Medium and Weak choices. Use to remove high-frequency noise from the image by smoothing.
	Median	Displays a drop-down menu with Strong, Medium and Weak choices. Use to replace noise spikes at the median of the surrounding area.
	Laplacian	Highlights edges (all directions) and either positive or negative brightness slopes.
	High Pass	Accentuates the high-frequency details of an image while leaving the low-frequency content intact.
	Plane Subtract	Displays a pull-down menu with three selections for removing the tilt of the image to the best fit plane. Least Squares Plane Subtract.  Automatically finds the least squares plane fit to the entire image and subtracts it. 3-Point Plane Subtract.  Defines a flat plane for image background removal 3 based on three user-selected points in the image. Use once to select points and a second time to subtract plane. Smooth Plane Subtract.  Subtracts a smoothed background from the original image. This is similar to a high pass filter.
	Flatten Subtraction	Allows you to level the image using three techniques. Refer to **Flatten** for more information.
Tools	Pixel Tool*	 Permits you to place a cursor on any pixel in the image and displays the coordinates in the status bar.
	Profile Tool*	 Permits you to draw a line on the image to obtain a profile of the image surface.
	Region Tool*	 Permits you to place a rectangle on a region of interest in the image to obtain information on the surface in that region and zoom in on the image.
	Customize	Displays the Customize dialog for customizing the toolbars, commands and keyboard accelerators in ImageStudio.
Window*	Cascade	 Arranges open image files in an overlapping manner.
	Tile Horizontally	 Arranges open windows on top of each other.
	Tile Vertically	 Arranges open windows side by side.

MENU	COMMAND	DESCRIPTION
Window* continued	Zoom In	 Expands the displayed image.
	Zoom Out	 Restores an expanded area one level
	Reset Zoom	 Returns the expanded or reduced image to the original state.
	Close All Windows	Closes all open files.
	Names of Open Files	Lists the names of the open files.
Help	About ImageStudio	Displays copyright, trademark and version information about this software.

Appendix

B Specifications

Modes Smooth (phase), Texture (white light), Microscope Only

Computer Latest generation Pentium computer with keyboard and mouse, Windows™ operating system, Xi-100 Image Studio data acquisition and analysis software.

Monitor TFT Flat Panel Monitor

X and Y Range

Objective	50X	20X	10X	5X	2.5X
XY Range	100 µm	250 µm	500 µm	1 mm	2 mm

Z Range Up to 100 mm

Minimum Z Resolution* <1 nm
*Resolution varies with measurement mode and with the number of measurements averaged.

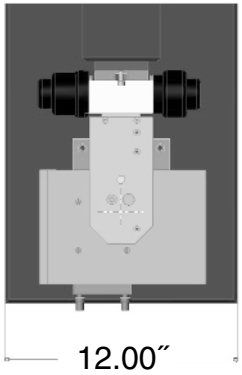
Sample

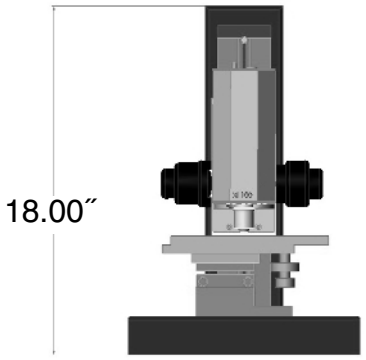
Surface Reflectivity Must be at least 2%

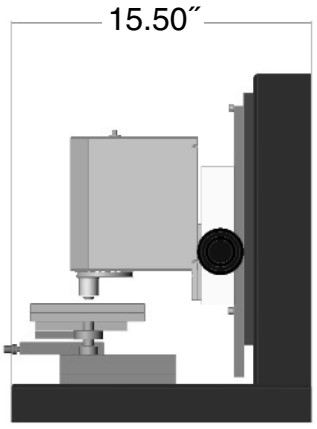
Sample Size 8″ x 8″ x 1″

Bulb 12 Volt, 20 Watt Halogen Bulb

Dimensions







Appendix

C Troubleshooting and Maintenance

Other than the procedures in this manual, there is no user service or maintenance that can be done for the Ambios Xi-100 Non Contact Optical Profilometer. If any problems arise, or if you have any questions, please contact the Ambios Customer Service Department.

Troubleshooting

Missing/Bad Pixels

To reduce the number of bad pixels in an image:

- Reset the contrast (especially for low reflectivity samples) using the Auto Light button.
- Adjust the tilt.
- Change the operating mode from *Smooth* mode to *Texture* mode if the sample features exceed the range of smooth mode.
- Change the objective to a higher magnification or tilt the sample toward the objective if the sample has a steep slope.

For the instrument to work there must be at least 2% surface reflectivity.

No Light/Excessive Contrast

- Click the Reset Light button on the Capture screen to go back to the default settings.
- Check for a blown bulb by placing a piece of paper under the objective to see if the green light appears. If it doesn't, make sure the instrument is on, and replace the bulb as necessary.
- Circuit problem. Contact the Ambios Customer Service Department.
- Make sure the cable is connected properly to the Xi-100 Refer to **Hardware Installation** for more information on installing the Control cable.

No Video Image

- Make sure the cable is connected properly to the Xi-100. Refer to **Hardware Installation** for more information on installing the Video cable.

- The lens may be too far out of focus. Use the Coarse Focus knob or put something under the sample to fix the focus range between the objective and the sample.

Sample Won't Fit Under Objective

- Optics Box mounted too low. Remount the Head Unit. Refer to **Hardware Installation** for more information on installing the Head Unit.

Fringes in Image Will Not Stay in Focus

- Tighten the Tensioner knob (the knob closest to the microscope on the left side of the Xi-100) by turning the knob counterclockwise. This will stop any drifting problem.

- If there is too much vibration, consider purchasing a Vibration table directly from Ambios.

Computer Maintenance

For information on maintenance and service of the computer, please contact the Ambios Technology technical support hotline.

1.877.429.4200 Within the US
831.429.4200
831.427.1160 FAX
service@ambiostech.com

Index